ISSN 1553-9768 Summer 2007 Volume 7, Edition 3

Journal of Special Operations Medicine

A Peer Reviewed Journal for SOF Medical Professionals

Volume 7, Edition 2 /Spring 07

Journal of Special Operations Medicine

ISSN 1553-9768

THIS EDITION'S FEATURE ARTICLES:

- CME---Transfusion Medicine
- Special Operations Medicine: A Federal Law Enforcement Perspective
- CME---Community Acquired Methicillin Resistant Staphylococcus Aureus
- Amputation of a Finger — A Stark Reminder
- Rapid Reversal of Warfarin Toxicity Using Recombinant Factor VIIa in a Deteriorating Patient with Left Hemothorax

Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2007		**00-00-2007 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Journal of Special Operations Medicine, Volume 7, Edition 3	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Joint Special Operations University,357 Tully Street,Alison Building,Hurlburt Field,FL,32544**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**116**	

COVER

ISSN 1553-9768

GEN Doug Brown, Commander of U.S. Special Operations Command, is pictured visiting troops in Tolemaida, Colombia. Brown retired 9 July, 2007, after 40 years of service. *Photo by Lt Col Dagvin Anderson.*
See interview in Current Events section.

From the Editor

The Journal of Special Operations Medicine (JSOM) is an authorized official military quarterly publication of the United States Special Operations Command (USSOCOM), MacDill Air Force Base, Florida. The JSOM is not a publication of the Special Operations Medical Association (SOMA). Our mission is to promote the professional development of Special Operations medical personnel by providing a forum for the examination of the latest advancements in medicine and the history of unconventional warfare medicine.

We need Continuing Medical Education (CME) articles!!!! Remember, our continuing education is for all SF medics, PJs, and SEAL corpsmen. In coordination with the Uniformed Services University of Health Sciences (USUHS), we also offer CME/CNE to physicians, PAs, and nurses.

JSOM CME consists of an educational article which serves to maintain, develop, or increase the knowledge, skills, and professional performance and relationships that a physician uses to provide services for patients, the public, or the profession. The content of CME is that body of knowledge and skills generally recognized and accepted by the profession as within the basic medical sciences, the discipline of clinical medicine, and the provision of healthcare to the public. A formally planned Category 1 educational activity is one that meets all accreditation standards, covers a specific subject area that is scientifically valid, and is appropriate in depth and scope for the intended physician audience. More specifically, the activity must:

- Be based on a perceived or demonstrated educational need which is documented
- Be intended to meet the continuing education needs of an individual physician or specific group of physicians
- Have stated educational objectives for the activity
- Have content which is appropriate for the specified objectives
- Use teaching/learning methodologies and techniques which are suitable for the objectives and format of the activity
- Use evaluation mechanisms defined to assess the quality of the activity and its relevance to the stated needs and objectives

To qualify for 1 CME, it must take 60 min to both read the article and take the accompanying test. To accomplish this, your articles need to be approximately 12 - 15 pages long with a 10 - 15 question test. The JSOM continues to survive because of the generous and time-consuming contributions sent in by physicians and SOF medics, both current and retired, as well as researchers. We need your help! Get published in a peer-review journal NOW! See General Rules of Submission in the back of this journal. We are always looking for SOF-related articles from current and/or former SOF medical veterans. We need you to submit articles that deal with trauma, orthopedic injuries, infectious disease processes, and/or environment and wilderness medicine. More than anything, we need you to write CME articles. Help keep each other current in your re-licensure requirements. Don't forget to send photos to accompany the articles or alone to be included in the photo gallery associated with medical guys and/or training. If you have contributions great or small… send them our way. Our e-mail is: JSOM@socom.mil.

Maj Michelle DuGuay Landers

Meet Your JSOM Staff

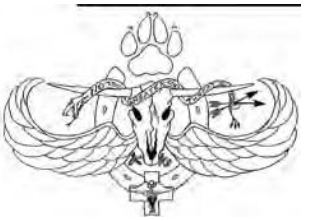
EXECUTIVE EDITOR
Warner Dahlgren Farr, MD
warner.farr@socom.mil

Colonel "Rocky" Farr was the distinguished honor graduate of his Special Forces 18D class in 1968 and completed 40 years of active service last April. He served as a recon team member with the 5th SFG(A) in SOG-Studies and Observations Group. He attended the DLI (German) and joined Detachment A, Berlin Brigade, an early special mission unit. He became the SF instructor at the ROTC Detachment, Northeast LA University and completed his BS. As a SFC, he taught in the 18D course and was selected for MSG. COL Farr was accepted to the Uniformed Services University of the Health Sciences and while a medical student, he was the medical platoon leader for the 11th SFG(A). He received his MD in l983 and has completed residencies in aerospace medicine, and anatomic and clinical pathology. He commanded Company F (ABN), 3rd BN, Academy BDE, Academy of Health Sciences as Course Director of the Special Operations Medical Sergeant's Course; and advisor to the 12th SFG(A). He was Chief, Department of Pathology, Blanchfield Army Community Hospital, and Flight Surgeon, 50th Medical Company (Air Ambulance), 101st ABN Division (Air Assault). COL Farr was the Division Surgeon of the 10th Mountain Division (Light Infantry) until becoming Deputy Commander of the U.S. Army Aeromedical Center. He attended the Air War College before becoming the Deputy Chief of Staff, Surgeon, U.S. Army Special Operations Command; Command Surgeon, U.S. Army Special Forces Command; and Command Surgeon, U.S. Army Civil Affairs and Psychological Operations Command. He became the Command Surgeon of the U.S. Special Operations Command in Tampa, FL in July 2006. He has numerous operational tours to include Bosnia, Kosovo, Kuwait, Vietnam, Cambodia, and Afghanistan.

MANAGING EDITOR
Michelle DuGuay Landers, RN
duguaym@socom.mil

Lt Col (sel) Landers joined the Army Reserve in 1987 and served as a nurse in a Combat Support Hospital unit for three years before switching services in 1990 to become an Air Force C-130 Flight Nurse. She is currently an IMA reservist attached to the SOCOM/SG office where she has been in charge of management, production, publication, and distribution of the JSOM since its inception in Dec 2000. Lt Col (sel) Landers has a Bachelors in Nursing and a Masters in Business Administration/Management. Her 21 year nursing career includes being a flight nurse in both the military and private sector, 15 years of clinical experience in emergency and critical care nursing as well as being an EMT and a legal nurse consultant. She also served as the military liaison to her Disaster Medical Assistance Team (DMAT). Prior to the SG office, Lt Col (sel) Landers' experience at USSOCOM includes an assignment in the Center for Force Structure, Resources, Requirements, and Strategic Assessments.

Bob Vogelsang, COL, VC, USA
Senior Medical Editor



Dear JSOM Readers,

Rocky was recently faced with a glut of colonels here in the SOCOM Surgeon's office, so he started putting us to work. Since I am the other doctor in the office, he put me in charge of clinical operations. We have determined that this encompasses education and training, of which JSOM is a large part. Having submitted an article for the last issue of JSOM, I now know what is required from both the contributor and editorial staff to put forth a quality product, or what can inhibit such.

As the new Senior Medical Editor for JSOM, I would like to introduce myself and provide readers with my vision for this publication. First off, yes, I am a veterinarian. So what makes me qualified to be the senior medical editor of this journal? Well, I have eleven years of college jammed into my brain, the last seven of those as part of a professional health care degree program (Michigan State University College of Veterinary Medicine) and a graduate degree program (Masters in Comparative Pathology from University of California-Davis). During those California years, I also went through a surgical residency and became board-certified by the American College of Veterinary Surgeons. During the Gulf War I spent time with 3rd SFG(A) as the TF Executive Officer making sure the medical task force in Kosovo functioned in a well-oiled manner. My brigade HQ (30th Med) deployed to Iraq while I was still in Kosovo, but I returned to serve as its G3 (Rear) when 80% of its units were back at home station.

So yes, I do feel qualified for this job and yes, you really are getting the impression I'm trying to justify it maybe a little too much; but hey, we vets just don't get no respect. Come on, admit it, you appreciate us for the comedic relief we give at staff meetings and not for our medical prowess ("Hey doc, the old man is pretty cranky today, I think his anal glands are full – you think you can squeeze 'em for us to get him in a better mood….HA HA HA, etc.).

Onward ... it is my goal to assist our Managing Editor, Lt Col (select) Michelle Landers (congrats to Michelle on the selection and imminent promotion!), and JSOM contributors to continually improve the relevance, scope, and quality of this publication for its readership. There will now be another set of eyes to help review and proof the contents of the journal. I also intend to reintroduce feedback mechanisms through which the readers and authors/contributors can help us cultivate a better publication. However, we won't be able to make it better without your involvement. JSOM is really your journal, not ours. We put it out because a cross-section of the community wants it. There were previous attempts by Lt Col (select) Landers to solicit input from readers and contributors through the Readership Survey, but she received little feedback. Maybe, there is just no room for improvement, but if you don't like what you see and don't speak your mind, then we don't want to hear any belly-aching.

If you have never submitted an article or review or comment, please step up and do so. Worst that could happen is I say "this really stinks, try again," but more likely, we will assist you in getting it looking good to where we will both be proud to place it in this splendid publication. I especially encourage our enlisted providers to submit articles. You are where the meat meets the grinder and you surely have some experiences to support opinions on what is working, what is not, and how things could work better. Whether an 18D or SEAL corpsmen or a Ranger Medic, you have it in you to put pen to paper or finger to keyboard to create something that could benefit our community.

In closing, I am very eager to start being a part of JSOM and I look forward to interacting with its readers and contributors.

No greater threat than an Airborne Vet!

I can be contacted at either robert.vogelsang@socom.mil or 813-826-6031, DSN 299

Contents

Summer 07 *Volume 7, Edition 3*

From the Command Surgeon

WARNER D. "Rocky" FARR
COLONEL, U.S. ARMY
Command Surgeon
HQ USSOCOM

We are having the usual summertime PCS season in the office, but not me! Progress is being made on several key issues, some of which I could use some help. I am beginning to understand more and more how the joint command world works or does not work. As in everything, it all revolves around money. Since everyone wants money for their pet project and there is not enough money to go around, what this headquarters really does on the "Title X-Train, Organize, and Equip" side is apportion out and administer shortages. Therefore, when I tell someone that this needs to happen (read: "you need to give me money for this") they just do not magically say "sure Doc" and hand me the command checkbook.

Even rubbing your caduceus and saying "But if you don't, people will die" doesn't loosen the purse strings, because everyone can say that to some degree, whether it's asking for new airplanes or submarines or whatever. Therefore, you might ask, what IS the coin of the realm? Turns out to be requirements and lessons learned. This is something relatively foreign to Medics and medical officers. Nevertheless, even when you become educated to the process and can speak the J-8's language of resources, requirements, and force structure, we in medicine still have a unique problem. We have learned how not to fail.

If an infantryman runs out of ammunition, bad things happen in combat and the lesson learned is "take more bullets, don't run out." That is sent in to the USSOCOM J-8's Lessons Learned database. In addition, a new requirement is generated: "Need more ammo and ammo bearers on the manning and equipment documents." The organization then spends its money to buy more ammunition with an acquisition program and increase its force structure with ammo handlers. That senario reasonably sums up the purpose of the "Title X-Train, Organize, and Equip" side of this headquarters both in mission and how they do it.

However, Medics don't fail. We never show up and run out of bandages. We also never show up without an evacuation plan or surgical support, even when we don't have it organic to the unit or even if it wasn't in the published plan. We creatively work to ensure that people don't die from lack of medical care or evacuation whether or not our commanders tell us to and usually without them being aware of what we've done. I had a senior surgeon, great guy, very effective in his SOF job say "I told my general that if I had to come to him with a medical issue, I've failed." That's the kind of Soldiers we are: We don't fail, we don't fuss if not thought of by the planners or operators; we just make it happen seamlessly without any fanfare. However, the down side of this selfless and seamless service is ignorance on the part of the leadership concerning our problems. They are constantly lulled into a false feeling of security by the lack of problems identified by the Medics and the obvious good work that was done when they talk to survivors at Walter Reed.

Problems produce lessons learned and new/emerging requirements for equipment, units (force structure), tactics, and techniques – everything the military does. In medicine, we tend not to have lessons learned or unmet requirements because we creatively fix the problem. We all know that supporting level two medical resources are either too limited, not organic, or not the right size if begged, borrowed, or stolen, but

where's the requirement to have more? Or on the other hand, where are the lessons learned that says "need more," or "need bigger" or "need organic" or "need airborne" or "need air droppable?" This is the fight I have down here. I can only drive a requirement, here in the joint world, if the services have identified something as a requirement and cannot fix it themselves. Therefore, for a hypothetical example, if I go and say "we need more and bigger laboratory units" (hypothetical, remember, as we don't need more labs) the questions I am asked are:

1. What's the requirement?
2. Why should it be a joint (or MPF11 funded) requirement?
3. Why haven't the individual services identified it as a problem?
4. Why haven't the individual services done it? – it's their responsibility!
5. Show me where we've failed because we haven't had it?
6. Where are the lessons learned showing that we need it?

My answer tends to be "Well gee, we've always begged, borrowed, or stolen enough to make it happen, but we really need to stop that and do it right cause bad things will happen someday if we don't, and people will die." So, then they give the money to someone else who has (1) validated requirements backed up by (2) lessons learned. On that beg, borrow, and/or steal issue, since the transformed battlefield has a lot less on it to beg, borrow, and/or steal FROM, I think we desperately need TSOC (Theater Special Operations Command) Surgeons and senior medical planners to orchestrate the begging, borrowing, and/or stealing FROM and I'm fighting that battle also. A battle that is tougher without requirements and lessons learned.

As Colonel Kevin Keenan (he leaves JSOMTC 1 October 2007) says, "I was a Soldier, then I was a doctor, and now I'm a bureaucrat." Why am I telling you this sad story? Because I, and moreover the component surgeons, need lessons learned and new requirements identified to their respective G-8s, to support their arguments of manpower, new units, money, new stuff, everything. Then, if it can't be fixed at service level, I get a crack at it down here. In addition, some day you'll grow old and have to do this job too.

Captain Nancy A. Hazleton, MSC, USPHS 1946-2007

A generation of Special Forces Medic (18D) students, will remember Captain Nancy A. Hazleton, MSC, USPHS. She was the Operations and Training Officer at the Gillis W. Long National Hansen's Disease Research Center at Carville, Louisiana. Contact with the last "Leprosarium" in the continental United States began as an offshoot of the 18D course's OJT hospital phase for some students at Fort Polk's post hospital. Students then began to go to Carville for a week of their Fort Polk rotation to see Hansen's disease. The training there, because of then Commander Hazleton, was ideal. It was not just on Hansen's disease but on other chronic conditions in a near third world environment. This grew into a full-fledged OJT site and then was ultimately used as a flyaway Trauma Clinic 3 where entire 300-F1 classes were parachuted in for a week of trauma clinics and hospital rounds. The Company F (Airborne) S-3, SFC Hensley at that time, worked closely with Commander Hazleton who was thrust into unfamiliar territory working on drop zones, SEAL boats in the Mississippi River, and other requirements foreign to her. She performed magnificently even when the Admiral's golf cart ended up in the lake. We will miss her.

Captain Nancy A. Hazleton died from cancer on May 29, 2007, just two days after her 61st birthday. She was born 27 May 1946 in Santa Rosa, California to George and Verna Hazleton. Both her parents and older brother Tom preceded her in death. She is survived by three nephews and many cousins.

Nancy graduated from Pacific Grove High School in 1964. It was there that she played the saxophone and developed a lifelong appreciation of jazz. She went to San Jose State University earning her Bachelors and Masters Degree in Public Health from the department of Behavioral Sciences.

She spent several years in France. In 1971 she worked in the administration office of the Tanzania Embassy in Stockholm, Sweden where she studied Swahili in order to understand secret transmissions, an activity that would have had her fired if the consulate knew.

In the mid 1970s Nancy began her career in public health by joining the Commissioned Corps of the United States Public Health Service in the Region V of-

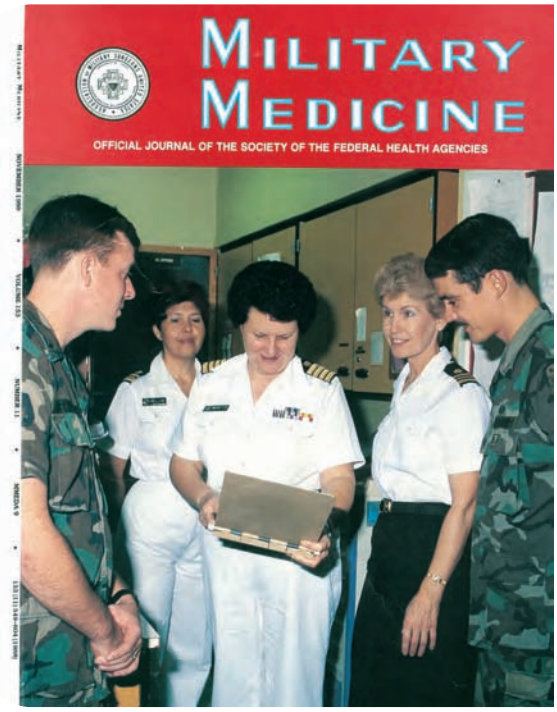
fice in Chicago, IL. It was there that she helped place healthcare providers into health manpower shortage areas. Afterwards she transferred to the state of Illinois' Public Health Department in Springfield, IL as the National Health Service Corps (NHSC) consultant for that state, doing the same thing she was doing in the Regional Office, but now only for the state of Illinois. She moved to Atlanta, GA, in 1984 and worked at that regional office. Two years later she relocated to Washington, DC, to work for the Office of Refugee Health.

She went to Carville, LA, in July of 1987 and worked in the training branch at the Hansen's Disease Center. It was her job to produce training materials and seminars to teach healthcare workers, primarily physicians, how to identify and treat Hansen's Disease (formerly known as leprosy). It was there that she qualified as an EMT. As a guest lecturer for Special Forces at Fort Bragg, NC, she arranged military training at Carville. During her tenure at Carville, she served a six month temporary assignment at the United States Embassy in Romania where she assisted with the efforts to improve the plight of orphans and bring some order to the adoption process being sought by many Americans.

She moved back to Washington, DC, in 1991 and worked in the National AIDS Program Office. It was in this position that she interacted with the White House on AIDS issues. After four years she transferred to the National Institutes of Health (NIH) where she served at the Office of Alternative Medicine and managed the medical education conference on complementary medicine as well as being key to the formation of the World Health Organization's (WHO) herbal medicine project at the NIH on investigating alternative medicines.

From 1997 to 2000 Nancy became the senior advisor to the assistant surgeon general. She was sent to Vietnam to set up the first Office of the Health Attache for the Secretary. After the bombing of the Nairobi and Dar es Salaam embassies in 1998, Nancy headed the advance team to Kenya and Tanzania representing the Office of the Assistant Surgeon General to prepare for President Clinton's delegation headed by Dr. Satcher (the Surgeon General) with medically trained private sector delegates from the U.S. These were dangerous times, but Nancy was up to the task. In 1999 she participated in the establishment of the first international attaché office (HHS) in Pretoria, South Africa.

In 2000 she again joined the NIH from which she retired on May 1, 2003 and moved to Tucson where she became involved in designing and creating jewelry. She also volunteered at the Tucson Animal Shelter taking pictures of the animals to assist their adoptions. In addition, she helped with the Tucson Symphony Auxiliary and the Friends of Hubble, an organization that assisted a trading post where Native American Artists were able to sell their works directly to the public.



SF Medics training at
Carville Hospital, 1988

ENLISTED CORNER

Senior Enlisted Medical Advisor (SEMA)
SOCM Glenn Mercer

During this last quarter we have been sanitizing the master database of the Advanced Tactical Practitioners within the claimancy. Several historic problems with the data have now been corrected. The primary thrust at this point is getting the demographics of each card holder to match their current geographic status. We have been successful at capturing and updating at the certification and re-certification milestones; however, those operators who have been otherwise constrained by op tempo are essentially missing data fields in the system. Be alert for any communication from the SOCOM medical training office as this is an attempt to find you, relative to your last assignment for duty. Ultimately this should, and will be, a web based system that functions beyond the read-only capabilities. The performance metric for our office here is turn around time. I strongly encourage any operator who has completed the requisites and not received a certification package to contact the SOCOM training office and get their account squared away.

The change of command has taken place here at SOCOM and we have our first Navy Admiral as Commander. As of this issue there are no major course corrections at the strategic and operational levels for the Combat Medics or direct support personnel.

We (senior enlisted) have been conducting a detailed review of recent casualty reports. A consistent theme is that our Combat Medics are routinely and habitually exposed to mass casualty environments as defined by the book. Clearly this validates the SOF doctrinal philosophy of de-centralization of training and equipment at the tactical level. Ultimately, I believe this is why TCCC was able to be a generational success in our organization as the competency of the operators allows us to overcome technical obstacles faster than the conventional forces. We have had some recent institutional successes with acquisitions and doctrine that were turning points for the SOF Medical community. However, that is old news. I want to see us capitalize on this inertia and get deep into the process development venue. For a Platoon SGT or Chief, waiting a year or more for a response to an After Action Report is just unsatisfactory. The recent casualty reports, wounding patterns, and demand analysis dictate that we need to reassess our entire fusion process at the global level. I intend to use the JMEAC and SOCOM Requirements Board for this function. Each casualty case on the ground has common after action assessments that can be used to evaluate fundamental gaps. Was the Medic prepared and trained to handle the job? Was the Medic carrying the material that allowed him to implement his core competencies at the point of injury? Was line leadership trained on the tactical and operational impact of casualties or mass casualties? Did research and development anticipate this circumstance two years ago? Was the personal protection effective or ineffective? From the process standpoint there are layers of agencies that support each one of these questions and not surprisingly layers of communication gaps that keep well intentioned people working in vacuums.

SOF medicine is a unique community within a unique community. Getting traction on issues sometimes requires both the hammer and anvil. To get this done we need the Medics to aggressively communicate up the chain. We are the owners of the Level 1 environ-

ment. To date, the Special Operations Lessons Learned Reporting System (SOFLLRS) has paid dividends, but it's only being used to a fraction of its capability by our constituents. The next thrust will be future Requirements and JMETLs for Combat Medics. That includes assessing what is going right. Our ability to articulate those successes will in part determine whether or not the answers to the questions in the previous paragraph are positive or negative responses. Given the fluid nature of the GWOT, we have to develop a synchronization and fusion process that works in terms of decades and is described doctrinally. Seven years ago a process called the SOF Truths was used in this claimancy. That process was a good start; however, it was local, organic, and simply never tied in to other supporting agencies. I intend to have this entire process refined by this year's SOMA Conference (10 to 13 December) and look forward to briefing our baseline.

Admiral Eric T. Olson takes command of USSOCOM following the retirement of General Bryan D. Brown on 9 July, 2007.

USASOC

Joe Caravalho, MD
COL, USA
Command Surgeon

USASOC Medicine Year-in-Review

As I transition back to the conventional Army, this is my last Component Surgeon submission to the JSOM. It has been an exciting, challenging, and professionally rewarding year for me and my medical directorate staff. Leaving USASOC, I'm filled with pride and a sense of personal good fortune for having served with the finest Soldiers in the business. I am immensely grateful to both Lieutenant General Robert Wagner and Command Sergeant Major (CSM) Michael Hall for their professionally supportive command climate, which has allowed our directorate to fully engage a number of difficult medical issues these past 12 months.

For starters, we coordinated a number of internal and extramural medical conferences, off-site meetings, and working groups throughout the year. This synchronized the Surgeon's mission, vision, and priorities with subordinate USASOC units, higher headquarters, outside federal agencies, and the Army Medical Department (AMEDD). Although not perfect, I'm pleased with the progress we've made in information-sharing throughout the community and beyond.

We formalized USASOC's Human Subjects Protection Program, in keeping with Congressional mandate, Department of Defense (DoD) directives, Secretary of the Army orders, and, finally, Office of the Army Surgeon General guidance. The USASOC Surgeon's Office has embraced Congress' intent to fully protect individuals involved in research activities, and as such, I have taken on the role of USASOC's Human Protections Administrator. Our formalized Human Use Committee provides Soldier protection oversight without unduly hindering USASOC's equipment testing mission.

Medical Communications for Combat Casualty Care (MC4) is the result of another Congressionally-mandated program, that being use of electronic medical records (EMRs) for deployed Soldiers. The Medical Logistics section facilitated a number of meetings with the MC4 staff, and began delivering handheld and laptop devices to our subordinate units. I fully understand how hard our deployed Soldiers have worked on these systems, and I appreciate their constructive comments. We do not have the final EMR solution, but I assure you USASOC's contributions will make a big difference in getting the Army and DoD to that point over time.

We've continued our participation in USSOCOM's Biomedical Initiative Steering Committee (BISC). I am personally very happy with the hard work our Medical Capabilities and Requirements Section is putting into the BISC. We continue to solicit research ideas from the field. I am particularly interested in common/repetitive injury prevention. In a Soldier-focused Army, USASOC will do well to direct the BISC towards keeping our operators in peak performance throughout their military and follow-on civilian careers.

Training has proven to be a complex issue for our Medics during the recent operational tempo. We

haven't lowered training standards, but we have increased decentralized flexibility to meet these standards. The recently updated medical portion of USASOC Regulation 350-1 fully addresses these issues. Regarding non-trauma training, I applaud 1st Special Forces Group's initiative for a centralized repository of common training slides. I'm hopeful my office can build on this concept, placing command-wide contributions on its widely accessible portal. These training sets can complement the face-to-face training already taking place at each of the units.

Finally, as the consultant to the Army Surgeon General for Special Operations medicine, I have worked hard with senior CSMs, both Special Warfare Center (SWC) and AMEDD proponents, and the Human Resources Command to increase assignment options and career opportunities for our AMEDD officers and non-commissioned officers (NCOs), as well as our Special Forces Medical Sergeants. I'm convinced decision-makers understand the importance of having well-placed medical professionals throughout the command. With that in mind, we have taken great pains to identify, assess, and select the very best officers and NCOs for USASOC. I'm also happy to note USASOC's increased NCO positions in the coming years. We also expect to get a Sergeant Major for our Senior Enlisted Medical Advisor soon. I expect continued growth in the future.

I haven't touched on everything we've gotten our hands on this past year, and I couldn't possibly acknowledge every great American who has had a hand in our accomplishments. I would be remiss, however, if I didn't publicly thank Colonel Kevin Keenan, SWC's Command Surgeon, for his undying loyalty, exceptional academic leadership, and his dedicated service to the Special Operations Medic. Over the last several years, he has influenced a generation of medical sergeants personally and indelibly. I dare say those who currently practice good medicine in bad places will owe him a personal debt of gratitude. We at USASOC wish him and his family the very best as he moves on to complete his active duty career in the Army Medical Corps.

So there you have it. USASOC medicine continues on azimuth. I'm glad to have been on board this past year, and I'm glad to have worked with each and every one of you Special Operations Medics and Army SOF medical professionals. Thanks for all that you do every day, for every Soldier in harm's way, and for every family member at the home front.

Be safe, train hard, continue to practice good medicine, and remember to share what you've learned through venues such as the JSOM.

Sine Pari!

COL Joe Caravalho was replaced by COL Dalton Diamond as the USASOC Command Surgeon on 20 July, 2007.
Welcome COL Diamond!

COMPONENT SURGEON

AFSOC

Timothy Jex, MD
Col, USAF
Command Surgeon

Let me start this quarter by welcoming some new faces to the AFSOC/SG staff. Col Bill Nelson just arrived as the new Chief of Aerospace Medicine, replacing Col Tim Robinette, who is heading to Japan to command the 374th Medical Group at Yokota AB. Col Nelson is an orthopedic surgeon and an Aerospace Medicine specialist who was previously assigned to the 352 SOG and 31 SOS, and is already well-known and respected in the AFSOC community. Lt Col Mark Ervin recently took over as the Chief of Medical Operations, replacing Lt Col Mike Curriston who retired. Lt Col Ervin is a general surgeon, was previously the director of AFSOC's Special Operations Surgical/Critical Care Teams, and brings a wealth of Special Ops experience to the table. Lt Col Lee Harvis will also be arriving later this summer as AFSOC's first pilot-physician. His primary focus will be working CV-22 Human System Integration issues (plenty to keep him busy!). He is a helicopter pilot and Aerospace Medicine specialist with more than 2,300 hours, including 60 plus combat hours in Afghanistan and Iraq. All three of these gents were in high demand for many other jobs, so I'm especially pleased to have won the assignments' arm wrestling matches in order to welcome such high quality additions to our staff!

In other AFSOC news, we are in the process of formalizing a partnership with the University of Montana in order to enhance our ability to conduct human performance (HP) studies. The University of Montana has been supporting the U.S. Forest Service for decades by conducting research relating to enhanced performance of wildland firefighters, and has become one of the premier HP research centers in the nation. The UM team is a high-speed, hard-core group that understands our mission and fits right in with AFSOC. I'm confident this partnership will pay huge dividends in the coming years as they help us develop the best strategies for enhancing performance, reducing injuries, accelerating rehabilitation, and even selecting the best candidates for air commandos in general, but particularly our battlefield airmen. As always, I encourage you to forward us your suggestions for future studies in these areas.

Finally, as follow-on to HMCM Mercer's comments about the ambiguous state of EMT-P certification in SOCOM; I am pleased to report that the Air Staff is moving forward to determine the best way to provide an Air Force sponsored formal training course with central funding for Air Force billets requiring EMT-P certification. Recognizing the fact that over half of the positions requiring certification are in MAJCOMs other than AFSOC, there is consensus between the MAJCOM Surgeons and the Surgeon General that this is a multi-MAJCOM issue which needs a centralized solution. A working group is currently weighing various options to make this happen. While we don't know the details of the final solution yet, this is a big step toward resolving a very long-standing and difficult issue.

We're engaged in a long war, but you are making a difference. Never forget your values, vision, and who you are – a key part of "the worst nightmare of America's worst enemies."

COMPONENT SURGEON

NAVSPECWARCOM

Jay Sourbeer, MD
CAPT, USN
Command Surgeon

I am concerned about a pressing issue for all components of Special Operations: Forward Resuscitative Surgical Capability.

Survival after combat injury is at an all-time high standard. Body armor and improved battlefield care contribute, but the other major contributing factor is forward resuscitative surgical stabilization, often within half an hour of injury.

Forward resuscitative surgical capability is the current standard of care expected by our professional warriors. It profoundly affects the power and sustainability of our war fighting at the individual, unit, and strategic levels. It strengthens the warriors going into danger. The ability to place fellow warriors out of danger and under anesthesia keeps the rest of the warriors in the fight even after casualties occur. In addition to saving our own personnel, enemy wounded denied martyr status become valuable assets. Casualty outcomes impact beyond the tactical level. In today's war they are a measure of success or failure, exerting profound effects at the strategic and political levels.

Time constraints require forward resuscitative surgical stabilization because travel requires too much time to get Wounded Warriors to overseas fixed U.S. facilities or to the few foreign facilities that approach United States surgical standards. Rapid response, high surgical standards, and the flexibility of military surgical teams are all integral parts of forward resuscitative surgical capability. This capability can only be achieved by co-location with teams attached to conventional forces or by bringing our own teams to support special operations.

The requirement for forward resuscitative surgical capability is now a critical issue for all Special Operations Forces because our current capability is entirely due to co-location with forward located conventional forces surgical teams. Special Operations forces rely on conventional forces to provide all but the battlefield echelon of care.

To bring forward resuscitative surgical capability to the unconventional warfare battlefields of the future, we must identify it as a critical capability requirement. Once this capability requirement is formally identified, we need to develop and maintain indigenous forward resuscitative surgical capability for unconventional warfare forces.

COMPONENT SURGEON

MARSOC

Stephen F. McCartney, MD
CAPT, USN
Command Surgeon

At the time of this writing the battle rhythm at MARSOC is steadily increasing. The 26th Marine Expeditionary Unit (SOC) has just offloaded and with that fine force of Marines, includes the Marine Special Operations Company Fox. The 2nd Marine Special Operations Battalion fielded Fox Co. as MARSOC's first MSOC to participate in the GWOT. We welcome Fox Company home with few wounded and no fatalities. Out west at Camp Pendleton, the 1st MSOB currently has had Alpha Company deployed in two AORs. Several other MSOCs (on both coasts) are meeting goals as they prepare for future deployments with the MEU.

Our medical growth within MARSOC continues steadily. I have had the delightful pleasure to interview the many enthusiastic Navy officer candidates who seek to serve with MARSOC. Many of these talented medical professionals have prior enlisted community backgrounds such as SARC, Navy SEAL, USMC, EOD, and prior deployments with SOF commands. The hardest job I have lately is having to make that Solomonic decision between two highly qualified individuals.

That being said, I welcome LCDR Mike Lappi, MC, USN as MARSOC's first Preventive Medicine Officer. He has extensive experience with NAVSPECWAR and carries a PhD in Environmental and Occupational Medicine. He comes to MARSOC from King's Bay, GA, where he served with the Atlantic Submarine Fleet. Thank you LCDR Shelton Lyons, MSC, USN, MARSOC, EHO for your many months of steadfast PMO support for MARSOC. Bravo Zulu!

MARSOC Medical is looking into the future and trying to design the best career paths for our SARCs and work closely with "Big Navy" to allow for their prolonged service with us. MARSOC's investment in the extensive specialized training (e.g., language, culture) is what will distinguish a MARSOC SARC from the prior Force or Recon battalion corpsman model and will drive the need for a robust return on our investment. In other words, longer tours with MARSOC are vital.

Our Marine Special Operations School had its first RSAS (recruit, screen, assess, and select) this May with good results. As the word gets out amongst the USMC we expect many to try to become MARSOC Marines. MARSOC is looking for the right Marine and Sailor, not necessarily the best Marine or Sailor. In the future, the corpsmen of MARSOC will also enter the same process. The criteria is being discussed by our SNCO community.

SOMA is now on for December 10 to 13 and I look forward to having MARSOC present some of what we have accomplished thus far. Our Marine Special Operations Advisor Group (MSOAG) has excelled in their FID missions and we look forward to sharing this with SOMA 2007 attendees. MSOAG Surgeon, LCDR Mike Shusko, has seen and treated many diverse diseases on deployments and left behind a long-lasting, positive imprint on those who have been fortunate to see him and his talented medical team.

As I close, I would like to stress that MARSOCs most powerful SOF warfighting asset continues to be its people. We are blessed to have them coming to us in MARSOC Medical. Our MARSOC Force Planner, Patrick Paul, the man who keeps me honest, was promoted to full Commander 2 July. Congrats Pat! In the same vein, I would like to congratulate Lieutenant Commanders David Krulak (MSOSG), Mike Lappi (MARSOC PMO), and Wes Cho (1st MSOB) for their recent selection to Commander.

MARSOC is like painting a car at 60 miles per hour. As we build MARSOC Medical we should also be changing it … the "Long War" will require nothing less. May God Bless America

CORRECTIONS

Corrections to Spring 07, Vol 7 Ed 2; Apologies to COL Vogelsang.
In the Feature CME article **Care of the Military Working Dog by Medical Providers**;

- Page 38; chart legend at bottom of chart in left column is missing:
  ▲ ranges are based on reviewing low and high normal values in numerous texts

- Page 41; the original image of the Orogastric/foal tube was of too low of a resolution to use but was incorrectly substituted. Below is the correct tube.

- Page 47; COL Vogelsang's name was misspelled and DVM was incorrectly typed as DMV.
- Page 63; CME test question # 2 was changed by the author but was not changed in the journal. Question #2 was supposed to be:

2. You determine Marco needs fluid support. Which of the following protocols would initially be appropriate for this patient?

a. 22G cephalic catheter, LRS, 20 ml/kg/hr CRI
b. 20G saphenous catheter, normal saline, 10 ml/kg/hr CRI
c. 14G cephalic catheter, 6% hetastarch, 50 ml/kg bolus
d. 18G saphenous catheter hypertonic saline, 20 ml/kg bolus
e. 18G cephalic catheter Plasma-Lyte 148®, 70 ml/kg/hr CRI

Education & Training

COL Bob Vogelsang
Deputy Surgeon for Clinical Operations

Education and Training Update

COL Farr has been very successful in creating a bigger (and hopefully better) USSOCOM Surgeon's office in his first year at the helm. A lot of that effort has gone to the Plans, Operations, and Logistics side of the house. However, the education and training side has not gone without its share and we have grown as well. It used to be pretty much Lt Col (select) Michelle Landers for JSOM and CPT Steve Briggs for everything else. Steve had the rest of the education and training enchilada outside of the journal, and even then, he wrote many an article for JSOM publication. When I got here, I dove into the veterinary issues like working dogs and LTT matters, but also tried to assist Steve here and there with administration of Advanced Tactical Practitioner (ATP) exams. However, Steve was still doing most of the heavy lifting. There was a need to do more in the education and training department, but the ATP program is pretty much a full time job.

I'm not exactly sure how we got all the newbies that we have and will get (and I don't want to), but the increase in warm bodies gives us the opportunity to create a more robust E & T section that should improve our service to our SOF Medics and Corpsmen. The influx of people (and abundance of colonels) led to the reorganization of the medical head shed here in Tampa. This reshuffling of the deck was done to give people more defined roles and responsibilities within the office instead of having to be jack of all trades and masters of none.

Basically, the office was cleaved in twain and aligned similar to the USSOCOM J-codes. COL Wyatt got most of the headache with Intel/Ops/Plans (J2/3/5), Manpower/Personnel, Resource Management (J1/8), and Log (J4). I got Doctrine, Education/Training (J7), Commo/IT (J6) and "Futures" (J9) which is actually pretty cool where you get to dream crazy, wacky stuff like unmanned aerial casualty evacuation vehicles, human performance improvement (Master Chief Mercer is getting us all professional sports-type conditioning trainers and programs) and, my favorite, the cybernetic working dogs that can smell IEDs from 100 yards away and detonate them with lasers coming out of their eyes, as well as being able to pee beer and make the team dinner and tuck them into bed. Oh, I did get the SOCOM clinic as well, so maybe COL Wyatt didn't get all the headache (why would a DZSO hold a smoke grenade long enough to burn his hand?? Yes, it happened).

Anyway, sticking to E & T, like everyone else, every single thing we do is done to support that operator farthest away, in the most gawd-awful place, with the fewest resources, at the most distant end of supply and commo lines, to do his duty and give him the absolute best chance for survival and a safe trip back home. And if we can help you kill a few bad guys in the process, well, we are glad to do it (that's a good thing about being a Vet; we don't have Geneva Convention protection and we can shoot first just because we can — I do really love this job). We were very fortunate to have had the talents of CPT Johnny Wayne Paul, APA-C for a few months though he is now working at SOCCENT. However, he was able to help out until LCDR Joe Patterson arrived in early July from the College of Naval Command and Staff who will take charge of "big T" training. He will have responsibility for the entire Command Medic Certification program, the biggest part of my domain. That requires him to battle with USSOCOM J7 to acquire funding to convene the Curriculum/Examination Board and produce and give ATP exams. CPT Scotty Gilpatrick, APA-C, DMO, just got here from the 160th Special Operations Aviation Regiment (Airborne) and will be the ATP exam guy. You have no idea what it takes to create and maintain everything needed to produce this thing. As mentioned above, it is really a full-time job and Scotty has it. We have also employed MSgt Diane Hinck to fill the Training NCO position. She will primarily take care of ATP certificates and cards, and maintain component ATP status (that is when the components occasionally send them). CPT Briggs will still be around for at least a little while. I won't let him go until he trains up all these new folks, though I have sent him to the SOCOM clinic for a couple months just so he remembers what being a PA is all about. Steve will likely be out of here by next May.

So Joe, Scotty, and the Training NCO to be named, will eventually give me time to work on the wazoo robot working dog thing and getting a vet to MARSOC (hopefully we got the first vet to the Rangers since Merrill's days by the time this issue gets out). It will also allow more time to work on finding a way for more throughput of Naval personnel at Ft. Bragg's Joint Special Operations Medical Training Center and, of course, for this fabulous publication. The medical education and training staff are here to serve the Nation, the Command, and its people, so we are interested in your feedback and ideas, even if they are wacky.

Outstanding Civilian Service Medal

The Outstanding Civilian Service Medal was established by the Commander, USSOCOM in September 1998 to recognize civilians who have provided outstanding support or service.

Approved by Commander, USSOCOM, this award is presented to civilians who have made contributions that have enhanced the mission, operational readiness, or operations of USSOCOM.

This award may also be presented to civilians who serve, or have served, with USSOCOM or units under its operational control and have made contributions that have enhanced the mission, operational readiness, or operations of USSOCOM beyond the normal performance of duties.

Component commanders and USSOCOM center directors may recommend civilians within their commands, directorates, or communities who have made contributions that have enhanced the mission or operations of USSOCOM. Guidance pertaining to the Outstanding Civilian Service Medal is described in USSOCOM Directive 672-5.

The USSOCOM OUTSTANDING CIVILIAN SERVICE MEDAL for 2007 was awarded to Dr. James R. Hammesfahr, Chairman, USSOCOM Medical Curriculum Examination Board. Dr. Hammesfahr received this award because of his exceptionally meritorious service and dedication as Chairman of the United States Special Operations Command's (USSOCOM) Medical Curriculum Examination Board (CEB) from 2 April 2003 to 14 March 2007. Dr. Hammesfahr has been instrumental to the USSOCOM Command Medic Certification Program. He ensured that USSOCOM established and validated an enlisted medical training and certification program based on Global War on Terrorism operational requirements. His unwavering support, hard work, attention to detail, and professionalism were critical in the development of the Advanced Tactical Practitioner's (ATP) Study Guide which is currently being utilized as an indispensable aide during the Joint Special Operations Medical Training Course for current and future operator Medics. Dr. Hammesfahr's dedication to the SOF Medic has been critical in the current Tactical Medical Emergency Protocols and the Protocol Drug List which are utilized at both the USSOCOM Components and Theater Special Operations Command's. His oversight and review of each ATP Certification Examination has provided immeasurable results and quality improvements that continue to make the Command Medic Certification Program the premiere medical certification program available today. The exceptional accomplishments of Dr. Hammesfahr highlight his distinguished career and service to his country and reflect great credit upon him, and the United States Special Operations Command.

Thank you Rick!

Current Events

GEN Brown was interviewed by Tip of the Spear editor Mike Bottoms prior to his 9 July retirement.

♠: Where is Special Operations Command today?

A: First let me say how proud I have been to command the great forces of U.S. Special Operations Command. Over three and a half years ago I took command of SOCOM after commanding Army Special Operations and JSOC, and those eight years have allowed me to see all of our forces operating around the world. Every unit, every operation in every part of the globe has had SOF Operators performing incredible missions, from foreign internal defense, to unconventional warfare, to civil affairs and psychological operations, to direct action. These Operators are dedicated to the task of freeing populations from oppression through the elimination of human suffering, improving peoples' lives, giving them hope, and training foreign forces so they can maintain their own sovereignty through security and good governance. Aircrews and boat operators continue to operate in the toughest of environments imaginable, doing missions that no other force could accomplish. Daily our people validate our system of selecting the right people, giving them world-class training and equipment, then empowering them to make decisions and operate as they need to. I am also extremely proud of our families. They have continued to sacrifice so that we could deploy these great forces to do the missions that are critical to this nation. Today's SOF are in great shape. Our forces are better trained and equipped than ever in history. Our modernization is on track to ensure the future relevancy of our force. Our schools are resourced at a level never seen in history. Over the past few years SOF have been in the spotlight as the nation struggled to find the right force for the type of warfare in the Global War on Terrorism. The realization that cultural awareness, language capability, high-level problem solving, and the maturity that have been emphasized in our SOF training schools has made our impact in the GWOT critical and was the catalyst for the growth and aggressive resourcing of our force.

♠: What is your vision for Special Operations Forces' future?

A: The future of SOF is very bright. We have been very well resourced, but the environment we find ourselves in today is more complex than any this nation has ever faced. This type of global war requires a different type of warrior, a warrior who understands cultures, languages, and who understands the secret to success is not in the direct action role, but in a combination of direct and indirect roles. The future is bright because there has been an acknowledgment within the Department of Defense and other government agencies that the skill sets SOF bring to the battlefield are critical in this type of war. However, we are not without challenges. SOF growth is a challenge. We will not sacrifice our standards in the selection process to Special Operations Forces as we grow. I am also very concerned about ops tempo. I don't see a change when our ops tempo decreases in Iraq and Afghanistan; it will increase in other areas. We will continue to train around the world with our partners as we continue to eliminate terrorism overseas. We are on a positive path to a strategy of capability designed at SOCOM and validated in the Quadrennial Defense Review. So again, I think SOFs future is bright, but I do not think there will be a reduction in the demand for what we do.

♠: The command celebrated its 20th anniversary this year. You have been part of this command since day one. Has the command fulfilled its intended role?

A: I think the command has performed better than ever imagined. We owe a huge debt of gratitude to people who built this command, such as the first SOCOM commander, GEN Lindsay; Rep. Dan Daniel; Sens. Sam Nunn and William Cohen; the first Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict, Jim Locher; and retired Army generals Sam Wilson and Dick Sholtes, and former Chief of Staff of the Army GEN Shy Meyer, to name just a few. These are the men who not only had the vision that resulted in the creation of USSOCOM; they had the courage to create the command in the face of what was not a popular idea. I think their vision has been realized many times over. Without these men and their vision, I don't think our nation would have been able to respond as quickly or in the manner that it did after the Sept. 11, 2001, attacks on the United States. Nor would we have had a Special Operations Force that could conduct sustained combat operations in Afghanistan and Iraq, plus deploy forces in other parts of the world in support of the broader war on terrorism, for more than five years. The Nunn-Cohen Amendment gave us great authorities. In my opinion, as SOF become more important on the type of battlefield we are on today, we have to ensure there is no erosion of the authorities granted to SOCOM under the Nunn-Cohen Amendment. We need to redouble our effort to educate our own forces within the command, as well as our service partners, about the authorities vested to the SOCOM commander.

♠: What is the state of interagency relationships since SOCOM became the lead planner and synchronizer of the Global War on Terrorism?

A: Interagency relationships are even better than I had envisioned. The interagency partners we have in our headquarters and the liaison officers we have in Washington, D.C., increase efficiency every day. I think one reason the interagency piece is working better is because throughout the government people understand the strategy SOCOM has written and see that SOCOM understands the importance of all the elements of national power to win the Global War on Terrorism. DoD is just one element and will not always be in the lead. I think the other agencies appreciate the fact that USSOCOM understands the complexity of the Global War on Terrorism strategy. Interagency relationships are getting much better, but there is obviously room for improvement that we are all striving for. We have a constant stream of interagency principals who visit the headquarters for discussions on the Global War on Terrorism that is working toward that end.

♠: What is your legacy to SOF?

A: I don't think I have a legacy specific to SOF. I think the wonderful performance of the people on the battlefield and doing the missions around the world are the legacy of SOF leadership. The members of Special Operations Command have taken the tools we have given them and taken this command to an extremely high level. I was for-

tunate to be here when this new role was envisioned for SOF with its associated growth, and I believe we have aggressively taken advantage of it. The SOCOM staff, which I could not be more proud of, has really developed the plans for the command to place it in a good stead for many years to come, both in operations and in resourcing.

♠: Do you foresee any challenges for the command?

A: I have already talked about the importance of not allowing the erosion of the Nunn-Cohen Amendment. I think in Special Operations Command we have allowed separate communities to grow, and quite frankly, that is not helpful. We need commanders at all levels to fix it now. I think it comes from a lack of understanding of the capabilities of the different communities, an imbalance of resources, and a blurring of mission sets. Another challenge is that bigger is not always better. I worry about people trying to build conventional capabilities in Special Operations. As our forces know, Special Operations units are trained, organized, and equipped to perform missions that conventional forces are not trained and organized to perform. We do not want to build conventional capabilities in SOCOM, nor should we. Bigger is not always better; we want to get it right, not just bigger. I think our plans for the future fix those problems, provided the plans are executed with discipline.

On the battlefield we have had a lot of direct action successes. While that is very important, direct action is not the key to success. Special Operations must be involved in separating populations from insurgents. SOF have those skills. I think the professional SOF Operator understands all this. Again, being in Special Operations has nothing to do with what kind of equipment you carry or certifications you hold; it has to do with how you think. Everyone in SOF has an important role to play and they must play their specific role to the absolute best of their capability. We owe that to the American people.

♠: Is there anything you would like to say to the men and women of SOF upon your retirement?

A: I would like to say to the Soldiers, Sailors, Airmen, Marines, DoD civilians, and contractors that it has been a real honor to work with them and serve with them for the last 40 years. I am especially proud of all my time in SOF, and specifically how the command has taken on these new missions with skill and professionalism. I'd also like to say a special thanks to the families. We are blessed with incredible families who put up with incredible hardships, and very seldom do we get a complaint. I am told that the ops tempo and battlefield exposure experienced by our forces today is greater than that experienced by our great veterans of World War II. This places enormous pressure on young families, and we owe them a deep debt of gratitude.

It has been an incredible 40 years and there is no greater honor than to depart as the commander of the world's most capable Special Operations Forces. I will watch from the sidelines with great pride as SOF continues their unparalleled successes. God bless all of you.

Front cover: GEN Doug Brown, Commander of U.S. Special Operations Command, is pictured visiting troops in Tolemaida, Colombia. GEN Brown retired 9 July, 2007, after 40 years of service. He entered the Army in 1967 as a private in the infantry and immediately entered training for Special Forces. After completing the Qualification Course, he served on an A Team in the 7th Special Forces Group at Fort Bragg, NC. After completion of Officer Candidate School, he attended Army Flight School at Fort Rucker, AL. During his career, he has been involved in combat operations in Vietnam, Operation Urgent Fury, Operations Desert Shield and Desert Storm, and several others. He is the first member of the Army's Aviation Branch to be promoted to the rank of four-star general.


UNITED STATES
SPECIAL OPERATIONS COMMAND

From the Navy Operational Medical Lessons Learned Center

TOPIC:

Severe Burn from QuikClot® Use

OBSERVATION:

A service member was wounded in OEF: GSW to his right forearm with a relatively minor wound with a transection of his ulnar artery that was subsequently ligated in theater. The Medic who treated him initially applied a tourniquet and a QuickClot® dressing to his forearm. **The dressing literally cooked everything in the volar aspect of the service member's distal forearm, including the medial and ulnar nerves that were previously intact. There was also extensive full thickness skin loss due to third degree burns and complete fibrosis of all the flexor tendons in the distal third of the service member's forearm and hand. With only one viable artery in the forearm, soft tissue coverage options are limited.**

There is a newer type of less exothermic QuickClot® out now: HemCon®; however, the concern is that as long as the old stuff is out there, folks will continue to use it. The AMEDD published a policy memo in July 2005, recommending use of the more expensive HemCon® dressing due to a lesser likelihood of patient harm.

We have alerted the AMEDD C&S, division and theater surgeons, along with several others, of this event. The manufacturer will be notified, as well as the FDA.

DISCUSSION:

QuickClot® can be a life-saving intervention in the face of severe external bleeding. The potential for significant burns as described above, however, is the reason that the TCCC guidelines recommend that HemCon® be the hemostatic agent of first choice and that QuickClot® be used only if HemCon® fails.

RECOMMENDATION:

That the TCCC Guidelines as outlined below be followed for battlefield trauma care.

2006 Tactical Combat Casualty Care Guidelines

CARE UNDER FIRE

1. Return fire/take cover.
2. Direct/expect casualty to remain engaged as a combatant, if appropriate.
3. Direct casualty to move to cover/apply self aid if able.
4. Try to keep the casualty from sustaining additional wounds.
5. Airway management is generally best deferred until the Tactical Field Care phase.
6. Stop *life-threatening* external hemorrhage if tactically feasible:

- Direct casualty to control hemorrhage by self aid if able.
- Use a tourniquet for hemorrhage that is anatomically amenable to tourniquet application.
- For hemorrhage that cannot be controlled with a tourniquet, apply HemCon® dressing with pressure.

TACTICAL FIELD CARE

For hemorrhage control in the Tactical Field Care phase, the Prehospital Trauma Life Support manual states: "For casualties in whom conventional pressure dressings do not control bleeding, the first hemostatic agent that should be ap-

plied is the HemCon® dressing. If adequate hemostasis is not achieved with the HemCon® dressing, it should be removed and QuikClot® powder applied."

IMPLICATIONS: (What will happen if recommendation is not followed?)

There will be more avoidable instances of severe pain and tissue damage as described in the observations section above.

COMMENTS:

Hemostatic Agents (From USAISR/NOMLLC paper TCCC 2007: Evolving Concepts and Battlefield Experience.)

No hemostatic agents had been approved by the FDA and proven to be effective in stopping life-threatening hemorrhage at the time of the publication of the original TCCC guidelines, so these agents were not addressed at that time. By the 2003 revision however, a number of candidate hemostatic agents to aid in the control of battlefield bleeding had been developed. The agents best supported by data from ongoing studies at the time (Alam 2003, Pusateri 2003, Sondeen Hemostatic Dressings 2003, Alam 2004, Pusateri 2004) as being able to stop massive hemorrhage were reviewed by the committee. Both the chitosan-based bandage HemCon® and the zeolite powder QuikClot® were judged to be effective based on study findings to date. Although the committee was not able to identify a clear winner based on efficacy, there were concerns about burns from the exothermic reaction produced by QuikClot® (Wright 2004, Pusateri 2004, Burris 2003) and HemCon® was selected as the initial TCCC hemostatic agent of choice (McSwain 2003).

A re-evaluation of the hemostatic agent recommendation was conducted by the CoTCCC for the 2006 TCCC guidelines. A focused meeting of the CoTCCC was conducted on this topic. Combat-experienced first responders and trauma surgeons were asked to describe their experiences with both QuikClot® and HemCon®. The Army and Special Operations forces had been issuing and using HemCon® while the Marine Corps and Air Force had elected to use QuikClot®. The findings from Wedmore and his colleagues noted below were presented, as were case reports from the TCCC Transition Initiative (Butler 2006). Published accounts of QuikClot® use on the battlefield were not available at the time of this review, although it had been reported successful in one trauma surgery patient in whom other attempts at operative hemostasis had failed (Wright 2004). Several Navy corpsmen assigned to the Marine Corps described successful uses of QuikClot® on the battlefield. Although there were reports of pain on application from use of QuikClot®, there were also anecdotal reports of lives saved by use of this agent. Trauma surgeons caring for USMC casualties reported that tissue damage from QuikClot's® exothermic reaction, while observed in the operating room, had not presented major problems nor had it resulted in significant additional tissue loss in the casualties in whom it had been used. Both agents have been shown to be effective in animal models of severe bleeding. (Alam 2003, Pusateri 2003, Sondeen Hemostatic Dressings 2003, Alam 2004, Ahuja 2006, Alam 2005). It was the finding of the committee that, once again, a clear winner in terms of efficacy was not evident. The revised position published in the 2006 guidelines was that BOTH agents should be carried by all combatants on the battlefield. HemCon® was recommended for use in the Care Under Fire Phase for cases of severe external bleeding not amenable to tourniquet placement. Both agents were recommended for use in the Tactical Field Care and CASEVAC phases of care, with QuikClot® to be used as a secondary agent if HemCon® had not been effective or was not available (McSwain 2006). This position was reiterated by a recently published review article on hemostatics (Pusateri 2006).

HemCon® has since been reported to be effective on the battlefield in a retrospective study of its use by Special Operations forces (Wedmore 2006). The authors reported 64 uses of HemCon® in combat casualties. In 97% of the casualties, HemCon® use resulted in cessation of bleeding or improvement in hemostasis. The majority (66%) of these uses followed treatment failures with standard gauze dressings. Use of HemCon® was most important in the treatment of superficial torso, head and neck, and very proximal limb injuries in which a tourniquet could not be applied.

Tarpey reported a case of QuikClot® use in OIF on a thigh wound with femoral bleeding in which the Medic was unable to stop the bleeding with a tourniquet. QuikClot® was poured carefully onto the wound and successfully stopped the bleeding without causing skin burns (Tarpey 2005). A case series of QuikClot® use has recently been prepared (Rhee in press). There were 83 external uses of this agent by first responders in the field and all were reported to be successful at controlling the hemorrhage. The exothermic reaction produced by QuikClot® produced pain that ranged from mild to severe in this series. There were three reported cases of skin burns with one burn requiring skin grafting (Rhee in press). In contrast, a Marine Corps battalion surgeon submitted a case series to the Navy Operational Medical Lessons Learned Center in which QuikClot® was unsuccessful in four battlefield uses, with two of the four casualties exsanguinating (NOMLLC Lesson Learned 8177). It is not clear from this report that direct pressure was used in conjunction with the QuikClot® application as the directions call for, so these failures may have been at least in part a training issue. Another recent report has described a series of four casualties with cutaneous burns from QuikClot® use (McManus 2007). The reports of pain and cutaneous burns from QuikClot® use strengthen the case for using QuikClot® only when HemCon® has failed or is not available.

Update on Teleconsultation Program (UNCLASSIFIED)

The Army's complete list of specialties to consult with approved contact groups is below. These consults are for use by deployed providers (Docs, PAs, SOF Medics).

Burn Injuries – burntrauma.consult@us.army.mil
Cardiology – cards.consult@us.army.mil
Dermatology – derm.consult@us.army.mil
Ophthalmology – eye.consult@us.army.mil
Infectious Diseases – id.consult@us.army.mil
Internal Medicine – im.consult@us.army.mil
Nephrology – nephrology.consult@us.army.mil
Neurology – neuron.consult@us.army.mil
Orthopedics – ortho.consult@us.army.mil
Pediatrics Intensive Care – picu.consult@us.army.mil
Preventive Medicine – pmom.consult@us.army.mil
Toxicology – toxicology.consult@us.army.mil
Rheumatology – rheum.consult@us.army.mil
Urology – urology.consult@us.army.mil

Other specialties "as requested."
Send email to project manager: chuck.lappan@us.army.mil.
Examples include:

Allergy	Endocrinology
EENT	Flight Medicine
Gastroenterology	General Surgery
Hematology	Legal (Army JAG & HIPAA)
Neurosurgery	OB-GYN
Oncology	Oral Pathology
Pharmacy	Plastic Surgery
Podiatry	Pulmonary Diseases
Psychiatry	Radiology
Speech Pathology	Vascular Surgery

We have included a pocket-sized card for you to cut out and laminate. Carry it on you for reference.

Update on Teleconsultation Program
Burn Injuries – burntrauma.consult@us.army.mil
Cardiology – cards.consult@us.army.mil
Dermatology – derm.consult@us.army.mil
Ophthalmology – eye.consult@us.army.mil
Infectious Diseases – id.consult@us.army.mil
Internal Medicine – im.consult@us.army.mil
Nephrology – nephrology.consult@us.army.mil
Neurology – neuron.consult@us.army.mil
Orthopedics – ortho.consult@us.army.mil
Pediatrics Intensive Care – picu.consult@us.army.mil
Preventive Medicine – pmom.consult@us.army.mil
Toxicology – toxicology.consult@us.army.mil
Rheumatology – rheum.consult@us.army.mil
Urology – urology.consult@us.army.mil
If you do not receive a recommendation for any teleconsultation within 24 hours, or for other specialties, please contact:
Chuck Lappan, Project Manager
(210) 295-2512 or chuck.lappan@us.army.mil

If you do not receive a recommendation for any teleconsultation within 24 hours please contact LTC(R) Lappan directly. The average turn-around time is three to four hours.

Chuck Lappan
Project Manager, OTSG Telemedicine Teleconsultation Programs Project
Manager, Telehealth Great Plains Regional Medical Command
Fort Sam Houston, TX
(210) 295-2512
chuck.lappan@us.army.mil

Transfusion Medicine

Troy R. Johnson, MD; Robert F. Kacprowicz, MD; Dan S. Mosely, MD

Abstract

Far-forward blood transfusion is a controversial topic. Transfusion of stored packed red blood cells (pRBCs) has come under increasing scrutiny in civilian trauma centers and may have fewer benefits than previously believed. The unnecessary transfusion of stored blood products has the potential to do significant harm, particularly when the blood has been stored for the long periods typically seen in the combat theater. Therefore, when transfusion is considered for an acutely injured patient, careful attention must be paid to the risks, benefits, and indications for transfusion. Once transfusion therapy is chosen, the provider must carefully adhere to established guidelines and procedures to minimize potential harm to the patient.

Accreditation/Designation Statement

CME: This activity has been planned and implemented in accordance with the essential areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Uniformed Services University of the Health Sciences (USUHS) and the Journal of Special Operations Medicine.

USUHS designates (this article **combined** with **Community Acquired Methicillin Resistant *Staphylococcus Aureus***) for a maximum of 1.7 ***AMA PRA Category 1 Credit(s)™.*** Physicians should only claim credit commensurate with the extent of their participation in the activity.

CNE: The Uniformed Services University of the Health Sciences (USUHS) is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

1.7 CNE contact hours are provided for participation this article **combined** with **Community Acquired Methicillin Resistant *Staphylococcus Aureus.***

Financial Disclosure

The authors of Transfusion Medicine, Troy R. Johnson, MD, Robert F. Kacprowicz, MD, Dan S. Mosely, MD, have indicated that, within the past year, they have had no significant financial relationship with a commercial entity whose product/services are related to the topic/subject matter.

Objectives

1) Identify the known adverse outcomes with the use of blood products.
2) Define the indicators for blood product transfusion.
3) List the common transfusion reactions and how to treat them.

Introduction

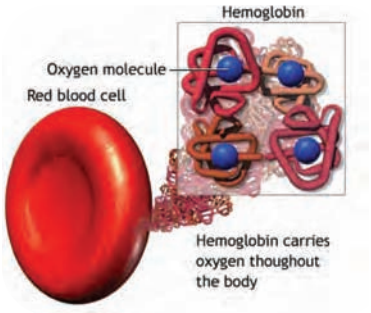
Throughout Operation Enduring Freedom and Iraqi Freedom, blood products have been available on the battlefield. Within the Special Operations environment, there has been great debate as to where the administration of these products could have the greatest benefit for our casualties. Anecdotal reports indicate that blood products are being administered far-forward in anticipation of shock, rather than as treatment when shock exists. Unfortunately, aside from the significant technical complexities of administering blood products far forward, there appear to be significant downsides to giving blood products to our patients. This is particularly true when blood products are given before they are absolutely necessary. When hemorrhagic shock that is unresponsive to fluid resuscitation exists, transfusion is clearly indicated. Giving blood products prior to that point, however, may actually be detrimental to our patients.

Many of the anecdotal benefits that exist with normalizing a patient's hemoglobin/hematocrit with pRBCs have not shown benefit in the current literature. As a result, many regional trauma centers have chosen to institute restrictive blood product protocols to minimize the many adverse effects. This shift to evidence-based practice in the hospital environment initiated more analysis of the cost-benefit relationship of the early utilization of these products. No prospective trials of administration of blood products in the far-forward setting exist, but study of the available literature on transfusion provides sensible conclusions for the use of blood products in the far-forward setting.

In view of the current practices of hypotensive resuscitation and tactical combat casualty care, a well researched, critical look at blood product placement and usage in the far-forward Special Operations environment is warranted. This article will review current literature on the topics published in the English medical literature. We will review the effects of blood storage and the current theories that account for some of the observed adverse effects. We will also discuss whole blood transfusion and potential blood replacements. We will finish with a review of suggested guidelines for administration, procedure, and hazards of blood administration in the far-forward environment.

Ex Vivo Blood Storage

The effects of blood product storage greatly influence its value during transfusion. The modern blood bank system has greatly extended the availability of blood products to the population, but the storage techniques have changed little since the 1940s. Storage of RBCs causes a number of morphologic and biochemical changes, which are only partially accounted for in the way that we measure post-transfusion RBC viability. We currently evaluate the viability by the post-transfusion RBC survival. This current standard is an arbitrary value of greater than 70 percent RBC integrity at 24 hours. Originally, this was deemed to be the value that would most reflect the measured hemoglobin and hematocrit post transfusion. Current authorities, however, would debate that this was the only achievable percentage at the time. There are no clinical outcome variables attached to this number or followed after its institution. Thus, while using this measurement improved the patient's lab values, the overall clinical benefit was never shown. Currently, RBCs stored up to 42 days maintain their 24-hour post-transfusion viability.[1]



The RBC is a highly specialized cell which can deliver oxygen to and remove carbon dioxide from the body. Its shape and deformability allow it to traverse the capillaries and microcirculation without structural or functional disruption. During storage, however, the RBCs are deprived of adenosine triphosphate (ATP), their energy source, and undergo many morphologic changes. Cytoskeletal protein loss forces the RBCs to lose their biconcave shape and thus limit usable surface area for gas exchange. They also lose surface sialic acid and membrane lipids. The loss of these membrane components results in an increase in the aggregation of the RBC and limits their deformability. Furthermore, through the loss of cellular antioxidants, hemoglobin is converted to methemoglobin which is incapable of binding oxygen. Finally, 2,3 diphophoglycerate (2,3 DPG) is depleted by the storage medium and subsequently decreases the existing hemoglobin's affinity for oxygen. This results in a decrease of the stored RBCs' ability to exchange gas and deliver oxygen through the microcirculation to the tissues.[2-32]

Packed RBCs represent only a portion of the whole blood that is initially collected. Plasma and platelets are removed in the processing prior to RBC storage. Though many elements are removed from the whole blood, the RBC component is far from pure. It contains many cellular components and bioactive substances, some of which are thought to contribute to many of the adverse

effects seen in the transfusion of stored RBCs. The increased presence of white blood cells in the RBC medium contributes significantly to RBC destruction and the subsequent leakage of potassium (K+) from the lysed cells.[33] Leukoreduction prior to storage has reduced, but not eliminated, this effect.[34]

Many of the remaining bioactive substances in the medium also adversely affect the RBC performance and limit the overall effectiveness of transfusion. These substances include histamine, lipids, cyotokines, fragments of cellular membranes, and human leukocyte class I antigens.[35-38] Some of these cytokines significantly contribute to the non-hemolytic febrile transfusion reactions seen in many patients. These reactions can be reduced, but not eliminated, with pre-storage leukocyte depletion.[39-42] The soluble lipids present in the medium are thought to contribute to increased platelet aggregation and host neutrophil activation.[43-46] Since these substances are not products or byproducts of white blood cells, leukodepletion does not reduce the incidence of side effects. In addition, many of these bioactive substances are thought to exist in levels high enough to produce systemic inflammatory responses. This inflammatory response is the current mechanism thought to produce much of the rise in morbidity and mortality seen in the utilization of stored RBCs.[47]

CLINICAL EFFECTS OF BLOOD LOSS

Anemia and Mortality

A substantial difference exists between clinically significant and diagnostic anemia. A healthy human is amazingly tolerant to the anemic state. Physiologic compensatory mechanisms, such as increased cardiac output and oxygen extraction can more than compensate for non–hemorrhagic shock levels of anemia. Normovolemic anemia to levels of 3.5 to 5.0 g/dL of hemoglobin has been shown to be adequate for organ perfusion.[48,49] As mentioned above, the logic of correcting anemia with RBCs has never been shown to improve oxygen availability or overall clinical benefit.[50-53] Evidence now exists of an overall harmful effect when patients are transfused to the previous standard of hemoglobin of 10g/dL.[54] The caveat to this, of course, is the adult with underlying cardiac dysfunction. A myocardial basal oxygen extraction rate of 55 to 70% leaves little capacity for improvement.[55] Thus, the only existing compensatory mechanism is increasing the coronary blood flow. This presents a particular problem for patients with baseline coronary artery disease. Several studies in the surgical literature show an increased post-operative mortality in these patient populations secondary to anemia.[56,57] One study, however, showed no discernible difference when stored RBCs were used to correct an underlying anemia.[58] This adds momentum to the rise of cell saver technology and autotransfusions of the patient's own blood during operative interventions. Thus, there is currently a lack of evidence to support transfusions in healthy anemic patients without evidence of organ dysfunction or hemorrhagic shock.

Population Based Studies of Adverse Outcomes

Two large population based studies have reported that transfusions alone are an independent risk factor for death.[59,60] Three retrospective and one prospective study in critically ill intensive care unit (ICU) patients show an increase in morbidity and mortality associated with transfusions alone.[61-64] This culminated in the landmark Canadian study showing the use of restrictive blood protocols increased survival in an ICU setting.[65]

Adverse clinical outcomes with the use of blood products include increased mortality, increased hospital length of stay, multiple organ system failure, increased infections, and impaired tissue oxygen utilization. Incidence of these ill-effects correlates with the age of the stored blood.[66-73] A prospective cohort study of 513 trauma patients found that transfusion is an independent risk factor for post-injury multiple organ failure. There is also an association between the number of units transfused in these patients and the number of complications.[63] Another study in trauma patients by Zallen et al. demonstrates that the mean blood age, number of units greater than 14 days old, and the number of units greater than 21 days old are also independent risk factors for multiple organ failure.[74] The many studies of post-coronary artery bypass graft (CABG) patients have shown similar effects to those as seen in the Zallen et al. study.[75-78]

A correlation between infections and blood product administration similarly exists. As described earlier, transfusion with allogeneic blood products expose the patient to large amounts of cellular and antigenic compounds, as well as bioactive substances that increase proinflammatory and immunosuppressive responses. TRIM, or transfusion related immunomodulation, is a theory first described by Opelz et al. that may explain some of the increased morbidity associated with transfusions.[79] Transfusion of pRBCs appears to cause transient suppression of the immune system. Immunosuppression after

RBC transfusion was initially found to be beneficial in recipients of cadaveric kidney transplants, but was also later found to be associated with increased rates of post-operative infections. Immunosuppression may therefore play a significant role in the increased rate of infection in patients who have received transfusion.[80-83] A prospective cohort study of trauma patients demonstrated that transfusions of RBCs stored greater than 14 days and 21 days are independent risk factors for post injury infection. The risk increased 13% for each unit that was greater than 14 days old.[84] Although this effect would not be seen on the battlefield, it is certainly cause for concern.

Finally, there is doubt as to whether the administration of red blood cells significantly increases the oxygen consumption capabilities of the body. Studies looking into the oxygen utilization pre- and post-transfusion show mixed results. Multiple studies clearly demonstrate that administration of older blood products decreases the oxygen consumption capabilities of the body.[85-90] Thus, the clinical benefit from blood more than 14 days old seems limited, and the potential for multiple adverse events actually increases.

Whole Blood Transfusion

The use of fresh whole blood for transfusion has largely ceased in the civilian sector, but continues to be utilized in the management of combat trauma in theater. Because of the lack of use in civilian medicine, however, a lack of outcome data exists to support or refute the use of whole blood transfusion. The majority of recent literature focuses on the utility of whole blood to augment component therapy in austere locations. Recent reports suggest whole blood has a role in the resuscitation of patients requiring massive transfusion (>10 units pRBCs) and others have used whole blood successfully when transfusion services and component therapy were exhausted or unavailable.[91-93]

In theory, the use of whole blood overcomes the limitations inherent in blood component therapy used in theater. When taken from a prescreened, walking donor pool, whole blood may provide significant benefit due to its lack of storage and avoidance of the aforementioned loss of efficacy in component therapy subjected to long storage times. Furthermore, the use of whole blood anecdotally provides rapid reversal of coagulopathy, an attractive feature particularly in combat when the patients are often hypothermic and have a resulting coagulopathy.[93]

Limitations to the use of whole blood are primarily related to the transmission of infectious disease, notably hepatitis C and HIV.[91] Current risk of transmission of hepatitis C from screened civilian populations is estimated to be 1 in 1.4 million, with the HIV transmission risk estimated to be 1 in 1.6 million.[94] While these risks are probably lower when blood is taken from the screened military population, the true risks are unknown.

Secondary risks include transfusion reaction, particularly when type-compatible, uncrossmatched blood is used in the emergency setting. Again, the true risk is unknown, but data from the use of whole blood in massive transfusion suggest the risk to be approximately 9%.[95]

At this point the use of whole blood in the far-forward setting should be considered experimental at best. The benefits of whole blood are attractive, particularly in theater when component pRBCs are often old and in limited supply, but the rate of transfusion reaction, the possibility of infectious disease, and the lack of proven benefit in controlled trials suggest whole blood use should be limited to the hospital/Level III setting where it can be used in a controlled fashion and studied prospectively. Using whole blood transfusion when hemorrhagic shock has not yet occurred is clearly not yet indicated and could be harmful.

Blood Substitutes

The promise of blood substitutes has kept Medics, doctors, and stock investors salivating for the last two decades. Blood substitutes would appear to be the ideal solution to many of the problems of both stored RBCs and transfused whole blood. The ideal blood substitute would eliminate the possibilities of allergic reactions, transmission of infectious disease, and would provide for long storage. All of these qualities would make blood substitutes ideal for use on the battlefield and in austere conditions. The focus of most recent research and development has been in the area of hemoglobin based oxygen carriers or HBOCs. In theory, HBOCs provide all of the desired qualities for a suitable blood replacement. Unfortunately, none have so far proven to be safe for use in humans.

Numerous attempts have been made to synthesize a solution that would allow delivery of oxygen to ischemic tissues. Recent history is littered with prospective solutions to the complex problem of oxygen delivery. Most of the recent attempts, however, have narrowed to a select few compounds that are based on hemoglobin molecules. Ideally, recombinant human DNA would be used to manufacture hemoglobin. Unfortunately, this has proven to be prohibitively expensive. Clinical trials are ongoing to evaluate the use of blood

substitutes, but recent data have been somewhat discouraging. The recent disclosure of increased mortality in patients treated with the blood substitute Polyheme® in a large prospective trial comparing the blood substitute to standard treatment has dampened enthusiasm for blood substitutes and made it unlikely they will be available for use in the operational setting for the foreseeable future.[96]

Transfusion Indicators and Procedure

Guidelines for the use of blood products in Special Operations exist.[97] These guidelines provide an easy framework for determining if blood products should be given. We suggest that stored, pRBCs should only be given under very isolated and precise circumstances. If the established protocols are not followed, the potential for doing great harm is high.

Transfusion should only be considered if the patient is in Class III or IV shock, as manifested by signs and symptoms consistent with blood loss greater than 1500cc. In the case of bleeding controlled with a tourniquet or hemostatic dressing, the appropriate indicator is persistent hypotension and tachycardia despite resuscitation with 500cc of Hextend®/Hespan® or two liters of normal saline (NS). If bleeding cannot be controlled (thorax, abdomen), transfusion should be considered when evidence of end-organ dysfunction exists and hypotensive resuscitation with Hextend/Hespan or NS fails to correct the end-organ dysfunction. Indicators of impaired end-organ perfusion include altered mental status/confusion in the absence of head injury, weak or absent radial pulse or pulse-oximetry readings of less than 90% with a good waveform and no chest injury. Transfusing in anticipation of these conditions may ultimately be harmful due to the many factors detailed in this review.[98]

Once transfusion has been selected, proper procedure must be followed to minimize the possibility of harm. Before beginning transfusion, ensure the patient has suitable intravenous (IV) access with an 18G catheter, as an absolute minimum. Once IV access is secured, obtain baseline vital signs and inspect the blood products. The responsible provider must ensure that the unit selected for transfusion is of type "O" only, is not expired, and does not appear to have any contaminants or air present. After the unit is inspected, Y-type blood tubing must be used for transfusion. The unit of blood is spiked with the line and a bag of NS MUST be used in conjunction with the unit of pRBCs. Prime the infusion set with NS and attach to the IV catheter. Once the infusion set is in place, administer the pRBCs by gravity flow for the first five minutes. Once it has been determined that no reactions have occurred, the blood should be given as rapidly as possible with a pressure bag at a pressure of 250 to 300mmHg. If any evidence of a transfusion reaction occurs, stop the infusion immediately and keep the unit with the patient for further evaluation once definitive care is reached.[98]

Transfusion Reactions

Once transfusion has been initiated, it is of critical importance to monitor the patient very closely for the occurrence of a transfusion reaction. The most serious complication of transfusion therapy is a hemolytic reaction which can result in serious, if not fatal, complications. If ABO-incompatible blood is given, the recipient's ensuing immune reaction will result in immediate destruction of the donor RBCs and a systemic immune response leading to worsening hypotension, renal failure, respiratory compromise, and/or disseminated intravascular coagulation.[99]

Symptoms of hemolytic transfusion reactions include fever, dyspnea, low back pain, worsening tachycardia, and hypotension. If symptoms of a hemolytic reaction occur, it is of critical importance to immediately stop the transfusion, monitor the patient's vital signs, and provide immediate resuscitation with normal saline. Airway control may be necessary and urine output should be monitored closely to maintain a rate of at least 100cc/hour.[99]

In the far-forward setting it may be difficult to differentiate less serious transfusion reactions such as a febrile reaction due to persistent leukocytes in the donor blood or a minor allergic reaction. In such cases, symptoms will be similar to a hemolytic reaction but less severe. Febrile reactions typically occur in a somewhat delayed fashion with fever, chills, and headache, but do not result in hypotension. Allergic reactions present with hives, chills, fever, flushing, or respiratory distress, and can become severe. Regardless of the suspected cause, the treatment in the operational environment is the same. The first priority should be to stop the transfusion and then manage the effects. Simple febrile reactions can be treated with acetaminophen. Diphenhydramine (Benadryl®) may be useful if an allergic reaction is suspected. If the reaction progresses, it is essential to provide supportive care and treat for anaphylaxis with epinephrine. Once the patient's condition is stabilized, be sure to keep the unit of blood with the patient for further evaluation and testing, once definitive care is reached.[98,99]

Discussion

There is little debate as to the effectiveness of blood transfusion in hemorrhagic shock patients. There seems to be a trend; however, in our combat environment to anticipate hemorrhagic shock, particularly when CASEVAC or MEDEVAC transport is involved. Giving blood products in the anticipation of hemorrhagic shock or for the correction of anemia in previously healthy and compensated trauma patients is clearly unwarranted and likely harmful to the patient. Couple this with the fact that since almost all of our blood products in theater are over 14 days old, the risk of harmful effects is even greater. While the use of whole blood is promising, its use has not yet been proven to be beneficial and also has significant associated risk. Like any medical intervention, giving blood products has advantages and disadvantages. Knowledge of the indications and precautions is essential in order to minimize adverse events and effects. Blood administration in the far-forward environment is technically difficult and predisposed to incorrect technique. This, in conjunction with the above mentioned multiple adverse effects on the patient when blood is given inappropriately or to early, produces a cost-benefit ratio which simply does not justify the use of currently available blood products in anticipation of hemorrhagic shock.

Clear guidance exists in both the Advanced Trauma Life Support (ATLS) manual and current literature as to when stored RBCs are indicated in trauma patients. This article is not intended to dissuade anyone from using stored RBCs in these settings. The intention is to ensure that all providers are aware of the adverse affects of giving stored RBCs and the direct correlation to negative outcomes seen when they are given to patients inappropriately. It is critically important to *only* administer blood products when clearly indicated and to follow correct procedures when choosing to administer blood in the far-forward setting. It is not only by the enemy's hands that our compatriots die. First, do no harm.

Dan S. Mosely, MD is a 1996 medical graduate of USUHS. He is board certified in Emergency Medicine and is currently the Command Surgeon of Systems Performance Office. He has multiple deployments in support of the Global War on Terrorism.

Robert F. Kacprowicz, MD is a 1996 medical graduate from Northwestern University. He has deployed in support of OIF and OEF, he is the former Medical Director of the Pararescue and Combat Rescue Officer School, and the current program director for the San Antonio Uniformed Services Health Education Consortium Residency in Emergency Medicine.

Troy Johnson, MD is a 1995 medical graduate of USUHS. He is board certified in Emergency Medicine and has multiple deployments in support of the Global War on Terrorism. He is currently the Deputy Commander for Clinical Services at Fort Drum, NY.

References

1. AABB Technical Manual. (1999). Thirteenth Edition. Bethesda, American Association of Blood Banks.
2. Knight JVRP, Martin L, Anstall H. (1992). Lipid peroxidation in stored red cells. *Transfusion*; 32:354–357.
3. Racek J, Herynkova R, Holecek V, et al. (1997). Influence of antioxidants on the quality of stored blood. *Vox Sang*; 72:16–19.
4. Knight JA, Searles DA. (1994). The effects of various antioxidants on lipid peroxidation in stored whole blood. *Ann Clin Lab Sci*; 24:294–301.
5. Wolfe LC. (1989). Oxidative injuries to the red cell membrane during conventional blood preservation. *SeminHemat*; 26:307–312.
6. Deepa Devi KV, Manoj KV, Arun P, et al.(1998). Increased lipid peroxidation of erythrocytes in blood stored in polyvinyl chloride blood storage bags plasticized with di-(2-ethyl hexyl) phthalate and effect of antioxidants. *Vox Sang*;75:198–204.
7. Knight JA, Searles DA, Clayton FC. (1996). The effect of desferrioxamine on stored erythrocytes: Lipid peroxidation, depformability and morphology. *Ann Clin Lab Sci*;26:283–290.
8. Knight JA, Searles DA, Blaylock RC. (1993). Lipid peroxidation compared in stored whole blood with various nutrient-anticoagulant solutions. *Ann Clin Lab Sci* 1993;23:178–183.

9. Valeri CR, Hirsch NM. (1969). Restoration in vivo of erythrocyte adenosine triphosphate, 2, 3-diphosphoglycerate, potassium ion, and sodium ion concentrations following the transfusion of acid-citrate-dextrose-stored human red blood cells. *J Lab Clin Med*; 73:722–733.
10. Valtis DJ, Kennedy AC. (1954). Defective gas-transport function of stored red blood cells. *Lancet*;1:119–125.
11. Hogman CFR MH.(1999). Storage parameters affecting red blood cell survival and function after transfusion. *Trans Med Rev*; 13:275–296.
12. Nakao M, Nakao T, Yamazoes S. (1960). Adenosine triphosphate and maintenance of shape of human red cells. *Nature*; 187:945–946.
13. Fitzgerald RD, Martin C, Dietz G, et al. (1997). Transfusing red blood cells stored in citrate phosphate dextrose adenine-1 for 28 days fails to improve tissue oxygenation in rats. *Crit Care Med*; 25:726–732.
14. van Bommel J, de Korte D, Lind A, et al. (2001). The effect of the transfusion of stored RBCs on intestinal microvascular oxygenation in the rat. *Transfusion*; 41:1515–1523.
15. d'Almeida MS, Gray D, Martin C, et al. (2001). Effect of prophylactic transfusion of stored RBCs on oxygen reserve in response to acute isovolemic hemorrhage in a rodent model. *Transfusion*; 41:950.
16. Wranne B, Nordgren L, Woodson RD. (1974). Increased blood oxygen affinity and physical work capacity in man. *Scand J Clin Lab Invest*; 33:347–352.
17. Woodson RD, Wranne B, Detter JC. (1973). Effect of increased blood oxygen affinity on work performance of rats. *J Clin Invest*; 52:2717–2724.
18. Rand PW, Norton JM, Barker ND. (1973). Responses to graded hypoxia at high and low 2, 3-diphosphoglycerate concentrations. *J Appl Physiol*; 34:827–832.
19. Arturson G, Westman M. (1975). Survival of rats subjected to acute anemia at different levels of erythrocyte 2, 3-diphosphoglycerate. *Scand J Clin Lab Invest*; 35:745–751.
20. Valeri CR, Rorth M, Zaroulis CG. (1975). Physiologic effects of transfusing red blood cells with high or low affinity for oxygen to passively hyperventilated, anemic baboons: Systemic and cerebral oxygen extraction. *Ann Surg*; 181:106–113.
21. Hovav T, Yedgar S, Manny N, et al. (1999). Alteration of red cell aggregability and shape during blood storage. *Transfusion*; 39:277–281.
22. Todd JC, Mollitt DL. (1994). Sepsis-induced alterations in the erythrocyte membrane. *Am Surg*; 60:954–957.
23. Betticher DC, Keller H, Maly FE, et al. (1992). The effect of endotoxin and tumour necrosis factor on erythrocyte and leucocyte deformability in vitro. *Br J Haematol*; 83:130–137.
24. Powell RJ, Machiedo GW, Rush BFJ, et al. (1991). Oxygen free radicals: Effect on red cell deformability in sepsis. *Crit Care Med*; 19:732–735.
25. Davidson LW, Mollitt DL. (1990). The effect of endotoxin on red blood cell deformability and whole blood viscosity. *Curr Surg*; 47:341–342.
26. Piagnerelli M, Zouaoui Boudjeltia K, Brohee D, et al. (2003). Alterations of red blood cell shape and sialic acid membrane content in septic shock. *Crit Care Med*; In Press.
27. Claster S, Chiu DT, Quintanilha A, et al. (1984). Neutrophils-mediate lipid peroxidation in human red cells. *Blood*; 64:1079–1084.
28. Davies KJ, Goldberg AL. (1987). Oxygen radicals stimulate in tracellular proteolysis and lipid peroxidation by independent mechanisms in erythrocytes. *J Biol Chem*; 262:8220–8226.
29. Powell RJ, Machiedo GW, Rush BFJ, et al. (1989). Effect of alphatocopherol on red cell deformability and survival in sepsis. *Curr Surg*; 46:380–383.
30. Sollberger T, Walter R, Brand B, et al. (2002). Influence of prestorage leucocyte depletion and storage time on rheologic properties of erythrocyte concentrates. *Vox Sang*; 82:191–197.
31. Heaton WA, Holme S, Smith Kea. (1994). Effects of 3–5 log10 pre-storage leucocyte depletion on red cell storage and metabolism. *Br J Haematol*; 87:363–368.
32. Ho J, Milkovic S, Gray L, et al. (2001). Transfusion of stored red blood cells (RBC) occlude the rat microvasculature in-vivo. *Abstr. Blood*; 98:544a.
33. Hogman CFR MH. (1999). Storage parameters affecting red blood cell survival and function after transfusion. *Trans Med Rev*;13:275-296.
34. Greenwalt TJ, Zehner Sostok C, Dumaswala UJ.(1990). Studies in red blood cell preservation: I. Effect of the other formed elements. *Vox Sang*; 58:85–89.
35. Smith KJ, Sierra ER, Nelson EJ.(1993). Histamine, IL-1B, and IL-8 increase in packed RBCs stored for 42 days but not in RBCs leukodepleted pre-storage. *Abstr. Transfusion*; 33[s]:53S.
36. Silliman CC, Clay KL, Thurman GW, et al. (1994). Partial characterization of lipids that develop during the routine storage of blood and prime the neutrophil NADPH oxidase. *J Lab Clin Med*; 124:684–694.
37. Muylle L, Joose M, Wouters E, et al. (1993). Increased tumour necrosis factor a (TNFa), interleukin 1, and interleukin 6 (KL-6) levels in the plasma of stored platelet concentrates: Relationship between TNF a and IL-6 levels and febrile transfusion reactions. *Transfusion*; 33:195–199.
38. Ghio M, Contini P, Mazzei C, et al. (2001). In vitro immunosuppressive activity of soluble HLA class I and Fas ligand molecules: Do they play a role in autologous blood transfusion? *Transfusion*; 41:988–996.
39. Stack G, Baril L, Napychank P, et al. (1995). Cytokine generation in stored, white cell-reduced, and bacterially contaminated units of red cells. *Transfusion*; 35:199–203.
40. Federowicz I, Barrett BB, Andersen JW, et al. (1996). Characterization of reactions after transfusion of cellular blood components that are white cell reduced before storage. *Transfusion*; 36:21–28.
41. Shanwell A, Kristiansson M, Remberger M, et al. (1997). Generation of cytokines in red cell concentrates during storage is prevented by prestorage white cell reduction. *Transfusion*; 37:678–684.
42. Kristiansson M, Soop M, Shanwell A, et al. (1996). Prestorage versus bedside white blood cell filtration of red blood cell concentrates: Effects on the content of cytokines and soluble tumour necrosis factor receptors . *J Trauma*; 40:379–383.
43. Silliman CC, Clay KL, Thurman GW, et al. (1994). Partial characterization of lipids that develop during the routine storage of blood and prime the neutrophil NADPH oxidase. *J Lab Clin Med*; 124:684–694.
44. Fransen E, Maessen J, Dentener M, et al. (1999). Impact of blood transfusions on inflammatory mediator release in patients undergoing cardiac surgery. *Chest*; 116:1233–1239.
45. Silliman CC, Voelkel NF, Allard JD, et al. (1998). Plasma and lipids from stored packed red blood cells cause acute lung in jury in an animal model. *J Clin Invest*; 101:1458–1467.
46. Silliman CC, Paterson AJ, Dickey WO, et al. (1997). The association of biologically active lipids with the develop transfusion-related acute lung injury: A retrospective study. *Transfusion*; 37:719–726.

47. Ho J, Sibbald W, Chin-Yee I. (2003). Effects of storage on efficacy of red cell transfusion: When is it not safe? *Crit Care Med*; 31:459–465.
48. Viele MK, Weiskopf RB. (1994). What can we learn about the need for transfusion from patients who refuse blood? The experience with Jehovah's Witnesses. *Transfusion*; 34:396–401.
49. Weiskopf RB, Viele MK, Feiner J, et al. (1998). Human cardiovascular and metabolic response to acute, severe isovolemic anemia. *JAMA*; 279:217–221.
50. Hebert PC, Schweitzer I, Calder L, et al. (1997). Review of the clinical practice literature on allogeneic red blood cell transfusion. *CMAJ*; 156(S9–S26):S9–S26.
51. Marik PE, Sibbald WJ. (1993). Effect of stored-blood transfusion on oxygen delivery in patients with sepsis . *JAMA*; 269:3024–3029.
52. Vincent JL, Baron JF, Reinhart K, et al. (2002). Anemia and blood transfusion in critically ill patients . *JAMA*; 288:1499–1507.
53. Malone DL, Dunne J, Tracy JK, et al. (2003). Blood transfusion, independent of shock severity, is associated with worse out come in trauma. *J Trauma*; 54:898–907.
54. Hebert PC, Wells G, Blajchman MA, et al. (1999). A multicenter, randomized, controlled clinical trial of transfusion require ments in critical care. *N Engl J Med*; 340:409–417.
55. Crosby E. (2002). Re-evaluating the transfusion trigger: How low is safe? *Am J Ther*; 9:411–416.
56. Carson JL, Duff A, Poses RM, et al. (1996). Effect of anaemia and cardiovascular disease on surgical mortality and morbidity. *Lancet*; 348:1055–1060.
57. Carson JL, Noveck H, Berlin JA, et al. (2002). Mortality and morbidity in patients with very low postoperative Hb levels who decline blood transfusion. *Transfusion*; 42:812–818.
58. Carson JL, Duff A, Berlin JA, et al. (1998). Perioperative blood transfusion and postoperative mortality . *JAMA*; 279:199–205.
59. Vamvakas EC, Taswell HF. (1994). Long-term survival after blood transfusion. *Transfusion*; 34:471–477.
60. Whyte GS. (1988). The transfused population of Canterbury, New Zealand, and its mortality. *Vox Sang*; 54:65–70.
61. Purdy FR, Tweeddale MG, Merrick PM. (1997). Association of mortality with age of blood transfused in septic ICU patients. *Can J Anaesth*; 44:1256–1261.
62. Maetani S, Nishikawa T, Tobe T, et al. (1986). Role of blood transfusion in organ system failure following major abdominal surgery. *Ann Surg*;03:275–281.
63. Moore FA, Moore EE, Sauaia A. (1997). Blood transfusion: An independent risk factor for postinjury multiple organ failure. *Arch Surg*; 132:620–625.
64. Hebert PC, Schweitzer I, Calder L, et al. (1997). Review of the clinical practice literature on allogeneic red blood cell transfusion. *CMAJ*; 156(S9–S26):S9–S26.
65. Hebert PC, Wells G, Blajchman MA, et al. (1999). A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. *N Engl J Med*; 340:409–417.
66. Vamvakas EC, Carven JH. (2000). Length of storage of transfused red cells and postoperative morbidity in patients under going coronary artery bypass graft surgery. *Transfusion*; 40:101–109.
67. Martin CM, Sibbald WJ, Lu X, Hebert P, et al. (1994). Age of transfused red blood cells is associated with ICU length of stay. *Abstr. Clin Invest Med*; 17(Suppl 4):B21.
68. Zallen G, Offner PJ, Moore EE, et al. (1999). Age of transfused blood is an independent risk factor for postinjury multiple organ failure. *Am J Surg*; 178:570–572.
69. Leal-Noval SR, Jara-Lopez I, Garcia-Garmendia JL, et al. (2003). Influence of erythrocyte concentrate storage time on postsurgical morbidity in cardiac surgery patients. *Anesthesiology*; 98:815–822.
70. Vamvakas EC, Carven JH. (2002). Allogeneic blood transfusion and postoperative duration of mechanical ventilation: Effects of red cell supernatant, platelet supernatant, plasma components and total transfused fluid. *Vox Sang*; 82:141–149.
71. Silliman CC, Clay KL, Thurman GW, et al. (1994). Partial characterization of lipids that develop during the routine storage of blood and prime the neutrophil NADPH oxidase. *J Lab Clin Med*; 124:684–694.
72. Fransen E, Maessen J, Dentener M, et al. (1999). Impact of blood transfusions on inflammatory mediator release in patients undergoing cardiac surgery. *Chest* ;116:1233–1239.
73. Chin-Yee I, Keeney M, Krueger L, et al. (1998). Supernatant from stored red cells activates neutrophils . *Transfus Med*; 8:49–56.
74. Zallen G, Offner PJ, Moore EE, et al. (1999). Age of transfused blood is an independent risk factor for postinjury multiple organ failure. *Am J Surg*; 178:570–572.
75. Vamvakas EC, Carven JH. (2002). Allogeneic blood transfusion and postoperative duration of mechanical ventilation: Effects of red cell supernatant, platelet supernatant, plasma components and total transfused fluid. *Vox Sang*; 82:141–149.
76. Silliman CC, Clay KL, Thurman GW, et al. (1994). Partial characterization of lipids that develop during the routine storage of blood and prime the neutrophil NADPH oxidase. *J Lab Clin Med*; 124:684–694.
77. Fransen E, Maessen J, Dentener M, et al. (1999). Impact of blood transfusions on inflammatory mediator release in patients undergoing cardiac surgery. *Chest*; 116:1233–1239.
78. Chin-Yee I, Keeney M, Krueger L, et al. (1998). Supernatant from stored red cells activates neutrophils . *Transfus Med*; 8:49–56.
79. Opelz G, Sengar DPMMR, Terasaki PI. (1973). Effect of blood transfusions on subsequent kidney transplants. *Transplant Proc*; 5:253–259.
80. Blajchman MA. (2002). Immunomodulation and blood transfusion. *Am J Ther*; 9:389–395.
81. Carson JL, Altman DJ, Duff A, et al. (1999). Risk of bacterial infection associated with allogeneic blood transfusion among patients undergoing hip fracture repair. *Transfusion*; 39:694–700.
82. Chang H, Hall GA, Geerts WH, et al. (2000). Allogeneic red blood cell transfusion is an independent risk factor for the development of postoperative bacterial infection. *Vox Sang*; 78:13–18.
83. Vamvakas EC, Carven JH. (1999). Transfusion and postoperative pneumonia in coronary artery bypass graft surgery: Effect of the length of storage of transfused red cells. *Transfusion*; 39:701–710.
84. Offner PJ, Moore EE, Biffl WL, et al. (2002). Increased rate of infection associated with transfusion of old blood after severe injury. *Arch Surg*;137:711–717.
85. Hebert PC, Schweitzer I, Calder L, et al. (1997). Review of the clinical practice literature on allogeneic red blood cell transfusion. *CMAJ*; 156(S9–S26):S9–S26.
86. Marik PE, Sibbald WJ. (1993). Effect of stored-blood transfusion on oxygen delivery in patients with sepsis. *JAMA*; 69:3024–3029.
87. Ronco JJ, Montaner JS, Fenwick JC, et al. (1990). Pathologic dependence of oxygen consumption on oxygen delivery in

acute respiratory failure secondary to AIDS-related *Pneumocystis carinii* pneumonia. *Chest*; 98:1463–1466.
88. Silverman HJ, Tuma P. (1992). Gastric tonometry in patients with sepsis: Effects of dobutamine infusions and packed red blood cell transfusions. *Chest*; 102:184–188.
89. Dietrich KA, Conrad SAHCA, Levy GL, et al. (1990). Cardiovascular and metabolic response to red blood cell transfusion in critically ill volume-resuscitated nonsurgical patients. *Crit Care Med* ;18:940–944.
90. Walsh TS, McArdle F, MacIver C, et al. (2001). Age of stored red cells does not influence indices of oxygenation after transfusion to critically ill patients: Randomized controlled trial. *Eur Soc Intensive Care Med* ;27:S247.
91. Repine TB, Perkins JG, Kauvar DS, et al. (2006). The use of fresh whole blood in massive transfusion. *J Trauma*; 60(6):S59-S69.
92. Sebesta JS. (2006). Special lessons learned from Iraq. *Surg Clin N Am*; 86:711-726.
93. Mabry RL, Holcomb JB, Baker AM, et al. (2000). United States Army Rangers in Somalia: An analysis of combat casualties on an Urban Battlefield. *J Trauma*; 49(3):515-529..
94. Dodd RY. (2004). Current safety of the blood supply in the United States. *Int J Hematol*; 80:301-305.
95. Sawyer PR, Harrison CR. (1990). Massive transfusion in adults. *Vox Sang*; 58:199-203.
96. Japsen B. Northfield Blood Test Turns Up Negative. Chicago Tribune. May 24, 2007.
97. Casevac Care. In: Prehospital Trauma Life Support: Military Verson (2007). 6th ed. NAEMT. St Louis, MO:Mosby; 540-545.
98 AFSOC Blood Products Guidelines Lecture. Accessed July 7, 2007. Available at: https://kx.afms.mil/kxweb/dotmil/file/web/ctb_029733.pdf.
99. Gorgas DL. Transfusion Therapy: Blood and Blood Products. in Roberts JR and Hedges JR (eds). Clinical Procedures in Emergency Medicine, 4th ed. Philadelphia: Saunders; 2004.

Special Operations Medicine: A Federal Law Enforcement Perspective

Daniel J. Schmidt, Special Agent, DEA

Abstract

This article details the overlapping mission between the Special Operations community and the U.S. Drug Enforcement Administration (DEA) mission. DEA and Special Operations Force (SOF) units operate together all over the world with DEA presence in over 100 foreign countries. The Law Enforcement (LE) mission and the SOF mission have very blurred lines that allow for a very close working relationship and similar counter-drug mission profile. The article specifically details the experiences in tactical medicine and the SOF Medic mission overseas relating one specific incident involving Special Forces (SF) and DEA personnel in a third world jungle operation. The article explains the strong bond between DEA and SOF personnel and lessons learned in the field relative to medical issues.

The mission for the military, especially the Special Operations community, and federal law enforcement agencies has certainly evolved into an overlapping operation. The Special Operations mission continues to increase the use of close quarters battle (CQB) operations, Special Response Team (SRT) entries, and an increasing role in peace-keeping law enforcement types of operations. This overlap is very evident in the drug war. Special Forces detachments rotate through every corner of the world in support of counter-drug operations.

I had the fortune of deploying on a three year tour with the DEA from 2002 to 2005. Special Forces teams in our area of operations (AO) were to train indigenous forces in small unit operations, counter-terrorism techniques, and counter-drug operations. I can state with conviction that the bond the Agents shared with these operators was very strong. We trained together and operated together and the mutual respect was evident.

Operating together, the Agents and the Special Forces teams developed a great respect and admiration for each other. There was an atmosphere where each side wished they could trade careers for a while! The training provided by the Teams was outstanding and while it was intended for the host nationals, most of the Agents took the opportunity to absorb the information and teachings from these experienced professionals. To the many specialty teams that rotated through our corner of the world, it was a great opportunity to share ideas, techniques, and missions.

Specifically, in the realm of CQB, there was a lot to share. DEA conducts thousands of search warrants, arrest warrants, vehicle assaults, buy-bust operations, and entries per year. Missions range from urban and rural reconnaissance, building and house assaults, marijuana eradication, methamphetamine lab entries, to maritime operations, etc. These are just the tactical situations and do not include the undercover work, technical operations and other daily operations within DEA's parameters. With over 100 foreign offices and multiple offices in all fifty states, DEA has a broad mission profile. Whether operating in the jungles of South America, the mountains of Afghanistan, or the mean streets of urban USA, the tactics and environments are always changing. No other federal agency handles as many operations or "contacts" per year as the DEA. This is a byproduct of the drug war. Small unit operations like those conducted by the DEA go hand-in-hand with SOF-type missions and training. While the ultimate goal of the mission may be different, the initial assault is very similar. As a tactical medic, I was especially pleased with the time the 18 Deltas (18D) took to share their real world knowledge. I found that of all the personalities inherent to the Teams, the 18Ds were most consistently the bookworms! The Medics really took the job of caring for the Team to heart and studied constantly to keep fresh and current on the full spectrum of medical issues. Learning everything from basic sick call to advanced trauma, with the real world mission experience to back proven techniques, is knowledge one can't receive in a classroom setting.

Operational Incident

One particular incident sticks out in my mind. During one mission we had a roll-over vehicle accident in the jungle involving three members of an SF Team. All three Operators, a Captain and two Sergeants, were ejected. The Team 18D and I arrived on the scene shortly after the accident; we were in a trailing vehicle. All three patients were conscious, but with obvious injuries. Patient 1 had a large laceration to the back of the head, serious pain and swelling in the lower left side of the rib cage, and a knee injury. Patient 2 had a baseball-sized hematoma over the left eye and various other areas of pain. Patient 3 advised us he had briefly lost consciousness and was complaining of nausea.

All three patients were transported to our hooch for follow-up treatment. Patient 3 appeared to have a concussion as did Patient 2. Fluids and O_2 were administered to all three and vitals were monitored. As the examinations progressed, Patient 1 began to show obvious signs of labored breathing. Patient 1 complained a great deal about the rib pain, and in a short time lost breath sounds on the left side. His rib injury was leading to a tension pneumothorax and possibly a hemopneumothorax. The 18D performed a needle thoracostomy which did allow some air to escape providing some relief, but the underlying issue was not fully corrected.

A determination was made that Patient 1 needed a chest tube. The patient was placed on a table and administered ketamine. After sedation took effect, the 18D continued the procedure. This was extremely impressive to see the skills of the operator and his confidence in performing this advanced procedure on a comrade in the middle of an unforgiving third-world jungle with no advanced medical facilities in the country. It was apparent that the 18D had completed many of these procedures before (as confirmed by a later conversation I had with him about his experiences in Afghanistan). I was amazed to see the almost immediate improvement in the patient's condition once the tube was in place and the excess fluids were draining.

As Murphy's Law kicked in, Patients 2 and 3 were stable, but a new patient entered the scene. An Agent started to have chest pain and dyspnea. The Agent had a history of angina that was especially active when in a heavy stress environment with little sleep or food. Prior to this incident, we had been on the operation for a couple days. A little O_2, fluids, and aspirin were enough to help out Patient 4, but you can imagine the situation. With limited supplies in a "hole in the earth" environment, we had two head injuries, a major chest injury, and now a cardiac issue.

Once Patient 1 was stabilized, we moved him to a waiting helo (1964 Huey) for a night flight to a city with a hospital capable of helping. Patients 2 and 3 were also transferred to a city hospital.

Lessons Learned

While this type of event was not the norm, it showed the capabilities of the 18D, and was a good teaching point for a DEA Agent/Tactical Medic operating in this environment. We certainly found that a multiple casualty incident chewed through supplies in quick order. Simple things like IV catheters, IV fluids, and compression bandages were utilized and disappeared rapidly. We found ourselves running to vehicles to retrieve back-up med bags for more IVs, etc. While it is not possible to carry a mobile hospital on the operator's back, it reminds us to carry extras of the most commonly used items and maybe fewer of the more obscure and lesser used materials. Certainly items with multiple uses have the best "space life" in the med kits.

This situation, along with the many MEDCAPs we conducted for the indigenous population, added to the "on the job" training environment. Working together with the 18D on issues of dentistry, broken bones, illnesses, skin diseases, puncture wounds, blast injuries, and the other daily sick call issues we were exposed to served to reinforce the need to train and stay updated on medical skills and knowledge. When you end up as the first phone call from your cohorts for their medical issues and/or emergencies with their TDY family members, you realize just how important your skills and training become. Especially in an overseas setting, families want someone they understand and trust helping them and/or their children. A Medic never knows what day they will be called upon to use those perishable skills they thought they would never use!

These situations also show where skills learned on foreign deployments carry over to domestic missions. I have looked back on many situations where I fine tuned a skill working in that third-world arena with the 18Ds that gave me the confidence to use that skill today. Every search warrant or enforcement operation we do brings another opportunity for those skills to come into play again.

I can say again with great sincerity that the bonds of friendship and mutual respect for the operators in DEA and those in the Special Forces are very strong.

Daniel Schmidt is a U.S. Drug Enforcement Administration Special Agent (SA) currently assigned to the Indianapolis District Office. SA Schmidt has been with DEA approximately 11 years with prior employment as a U.S. Border Patrol Agent. SA Schmidt was formerly assigned to offices in San Diego and Bolivia, South America, and is a DEA Firearms Instructor, Tactical/Raids Instructor, Defensive Tactics Instructor, and Tactical Medic.

Community Acquired Methicillin Resistant *Staphylococcus Aureus*

John S. Hammes, MD

Abstract

Community-acquired methicillin-resistant *Staphylococcus aureus* (ca-MRSA) is an important cause of illness among active duty forces in general and among Special Operations personnel in particular. It is increasingly common and has the potential to continue to spread to affect a large proportion of the population. This pathogen may cause degradation in operational readiness, time lost from training, and potentially disabling damage to soft tissues and joints. This article has several purposes. It will describe background and significance of ca-MRSA related disease, describe the clinical manifestations of ca-MRSA disease, explain how the bacterium causes illness, and explain the measures needed to treat and prevent the spread of ca-MRSA infections.

Accreditation/Designation Statement

CME: This activity has been planned and implemented in accordance with the essential areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Uniformed Services University of the Health Sciences (USUHS) and the Journal of Special Operations Medicine.

USUHS designates (this article **combined** with **Transfusion Medicine**) for a maximum of 1.7 ***AMA PRA Category 1 Credit(s)***™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

CNE: The Uniformed Services University of the Health Sciences (USUHS) is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

1.7 CNE contact hours are provided for participation in this article **combined** with **Transfusion Medicine.**

Financial Disclosure

The author of Community Acquired Methicillin Resistant *Staphylococcus Aureus*, John S. Hammes, MD, has indicated that, within the past year, they have had no significant financial relationship with a commercial entity whose product/services are related to the topic/subject matter.

Objectives

1) Describe background and significance of ca-MRSA related disease.
2) Review the microbiologic, clinical, and diagnostic features of ca-MRSA disease.
3) Explain the measures needed to treat and prevent the spread of ca-MRSA infections.

Background and significance

Why is ca-MRSA important? It is the rare pathogen which is virulent (i.e., has great disease causing potential), is highly contagious (has the ability to disseminate widely), and is resistant to most commonly used antibiotics.[1]

Ca-MRSA has become increasingly common both in civilian and military environments. More specifically, as many as 70% of community isolates of *Staphylococcus aureus* in Houston and Atlanta are resistant to methicillin and similar beta-lactam antibiotics.[2,3] While resistant strains of *Staphylococcus aureus* have been described since early in the antibiotic era, important changes in the origins, genes, ability to cause disease, and management of this germ have taken place in the last 10 years. For example, early MRSA bacteria and infections appeared to result from widespread use of antibiotics, particularly in healthcare settings. When it occurred in the community, it was typically a result of spread from a hospital or nursing home. However, present day ca-MRSA appears to be microbiologically different from what may be viewed as traditional, older MRSA.

The epidemiology of ca-MRSA should be of significant interest to military healthcare providers. Traditional MRSA often caused disease among immune-compromised and/or hospitalized hosts. Ca-MRSA most often causes disease among relatively young persons. The spread of ca-MRSA can usually be traced to close contacts such as family members, athletic teammates, or barracks dwellers. In fact, along with small children, athletes, and inmates of correctional facilities, military personnel are an identified population at risk for ca-MRSA infection.[1] In addition to recent experience reviewed below, outbreaks of ca-MRSA have been reported from Naval Special Warfare Center (NSWC) in 2002[4] and multiple other military sites, to include the U.S. Naval Submarine Force. Of 1,888 MRSA isolates found at Naval Medical Center San Diego (all obtained from Branch Medical Clinics and the tertiary hospital facility) between 1990 and 2004, 65.4% were ca-MRSA.[5] It is possible that some of these cases were from dependents or retirees, but clearly this pathogen has military relevance.

To underscore the significance of ca-MRSA, we reviewed medical attritions from four classes at Basic Underwater Demolition School (BUD/S) at NSWC in San Diego during a nine month period in 2006 (see Figure 1). Of students rolled back or dropped from training due to medical causes, 11% of these were due to ca-MRSA cellulitis and abscesses. The most serious of these involved bursae or joints and resulted in hospitalizations for intravenous antibiotics and surgical incision and drainage (I&D). In addition to serious illnesses and hospitalizations, ca-MRSA infections have resulted in over four hundred hours lost from training due to initial sick-call visits and follow up for repeat I&D and packing.

The two principal manifestations of infection with ca-MRSA are cellulitis and abscesses (95% of cultures in a study by Crum et al.) In the same analysis, the majority of sites infected involve the extremities, which is consistent with our experience at NSWC.[5]

In other large studies, skin and soft tissue infections remain the most common sites for infection with ca-MRSA. Indeed, most reports suggest that a majority (70 to 90%) of infections with ca-MRSA involve the skin and soft tissues. While hospital-acquired MRSA (ha-MRSA) also frequently involves skin and soft tissues, it appears to be more likely to result in infection of the bloodstream, respiratory tract, and urinary tract than ca-MRSA, according to a study of cultures obtained in Sacramento, California.[6] Clinical manifestations will be described further in a subsequent section of this article. While these infections may cause substantial morbidity, thus far, mortality has been exceedingly uncommon. Deaths, if they occur, are usually related to necrotizing pneumonia and associated overwhelming sepsis.[7]

Pathogenesis

Staphylococcus aureus organisms in general have demonstrated a unique ability to adapt and survive in a great variety of environments (just like Special Operations Forces!). Molecular and genetic analyses of this germ have shown that it may have a wide variety of molecules known as adhesins, which mediate adherence to and colonization of target tissues. This helps to explain how ca-MRSA may be easily transmitted among groups of people as well as its tendency to recur in the same patient over time.[8] Isolates of ca-MRSA have been analyzed and found to carry a specific gene known as mec A. This gene encodes a protein which does not bind well to beta-lactam agents such as penicillin, and helps to confer resistance to these drugs. Penicillin and other beta-lactam agents work by inhibiting the bacterial cell wall synthesis. This has a lethal effect on bacteria, especially on Gram-positive ones. The mec A gene is carried on what is known as a staphy-

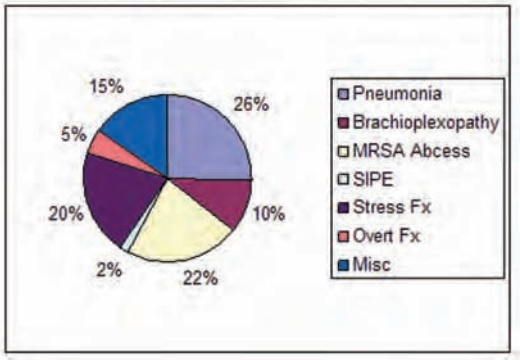


Figure 1

lococcal chromosomal cassette (SCC). The significance of this is that the gene and SCC can be used to conduct epidemiologic studies of outbreaks and identify that ca-MRSA is involved. Additionally, ca-MRSA isolates typically possess genes which code for a cytotoxin known as Panton-Valentin leucocidin. This factor is thought to give ca-MRSA the ability to destroy tissue and is associated with rapid formation of abscesses and tissue destructive pneumonias.[9]

On a more practical level, five "Cs" have been implicated in the transmission of ca-MRSA. These include **C**rowding, skin **C**ontact, **C**ompromised skin, sharing **C**ontaminated items, and lack of **C**leanliness.[1] Crowding is an obvious consequence of military training and operational environments. Potentially infected personnel are also placed in close contact with each other as a result of team building and other exercises. Trainees at NSWC and other Special Operations training environments are frequently exposed to abrasions and other trauma which may compromise the skin. Similarly, it is not unusual for trainees to share items such as towels, wetsuits, masks, and other gear items. Ca-MRSA has been cultured from patient examination tables, computer keyboards, a pulse oximeter, and patient chairs, which attests to the importance of proper infection control measures in clinic spaces.[9]

Diagnostic considerations

The typical presentation of a patient with ca-MRSA skin or soft tissue infection is a rapidly appearing area of induration and erythema which may or may not develop into an obvious swollen, abscess-like lesion (Figures 2 and 3). These infections may also resemble a spider bite (Figure 4) and patients not infrequently present with the complaint that they feel that they were bitten by a spider. While patients may be febrile, our experience at NSWC suggests it is rare, with less than five patients in over 100 presenting with temperature greater than 98.6 degrees Fahrenheit. While abscess/cellulitis are the most frequent manifestations of ca-MRSA, it is important to note that patients may present with sepsis, necrotizing (rapidly progressive and destructive) pneumonia, pyomyositis, necrotizing fasciitis, and other serious invasive infections, even among healthy individuals. Abscess lesions may drain spontaneously if left untreated, and may present with serosanguinous purulent material emanating from the lesion.

An important initial consideration in approaching a patient with a new skin or soft tissue infection should be index of suspicion. While these diseases were often caused by Group A Streptococcus species or methicillin-sensitive *Staphylococcus aureus* in the past, clinicians should be aware that the prevalence of ca-MRSA has rapidly increased in the USA.[10] As noted above, military personnel (particularly in the close quarters of a training environment) are a population at risk. Providers should have a low threshold for obtaining a swab of site material for culture and sensitivity testing from abscesses and other skin infections. While the sensitivity of culturing swabbed sites may be imperfect (70.9% in one study), culturing may prove useful if the infection spreads or proceeds to worsen rapidly or if it is unresponsive to a course of prescribed antibiotics. A slide latex agglutination test for detection of MRSA is highly sensitive and specific and is currently used in hospitals and laboratories in more than 17 countries.[11]

Figure 2
Ca-MRSA abscess of posterior leg with associated cellulitis.

Figure 3
Ca-MRSA abscess of hand status-post incision and drainage.

Figure 4
Ca-MRSA abscess with characteristic spider bite appearance.

We and others have also identified otitis media and externa associated with ca-MRSA. Patients treated for otitis with conventional antibiotics who present with persistent otorrhea should have the discharge swabbed and sent to a laboratory for culture and sensitivity testing.[12]

Management

The first step in appropriate treatment of ca-MRSA related disease involves a high index of suspicion and adequate recognition of the presentation. In one study from Atlanta, Georgia, two thirds of ca-MRSA cases were treated inadequately initially, probably because the providers did not recognize that the causative agent was resistant to beta-lactam antibiotics.[10] Ca-MRSA is typically also resistant to macrolide antibiotics such as erythromycin and azithromycin, as well as fluoroquinolone antibiotics such as ciprofloxacin.[13]

The following sections discuss the use of different agents in the treatment of suspected or proven ca-MRSA. However, these therapies have not been compared in vigorous clinical trials, and so it is not known what the ideal therapy is. General consensus favors the empiric therapies described below, as well as incision and drainage for abscesses.

The good news about ca-MRSA is that it is treatable. In contrast with older nosocomial strains of MRSA, it is usually sensitive to a larger number of antibiotics. Ca-MRSA is resistant to cephalosporins such as cephalexin and penicillin-derived antibiotics such as dicloxacillin. However, most ca-MRSA is susceptible to tetracyclines such as minocycline and to trimethoprim-sulfamethoxazole. Many ca-MRSA strains are susceptible to clindamycin, but development of resistance to this drug during therapy may occur.[14] Rifampin is also generally an effective agent against ca-MRSA. Table 1 describes specific medications, their dosages, and most common side effects.

Antimicrobial	Usual Dosage	Common Side Effects
Trimethoprim-Sulfisoxazole 160/800mg (Septra DS)	1 DS tablet every 12 hours	Nausea/Vomiting, Diarrhea, Rash
Minocycline	100mg every 12 hours	Photosensitivity, Nausea/Vomiting
Doxycycline	100mg every 12 hours	Anorexia, Nausea, Dysphagia, Rash
Rifampin	600mg once daily	Stomache upset, Discolored Urine
Clindamycin	300 to 450mg every 6 hours	Nausea/Vomiting, Diarrhea

All patients with furuncles or abscesses should have them drained. Drainage may be problematic, in that abscesses may be septated and may require significant pressure to break up septations and assure complete drainage. These procedures are often quite painful and poorly tolerated by patients. In our experience at NSWC, pre-medication with morphine sulfate 2 to 4mg or with fentanyl 50 to 100mcg IV may help mitigate pain and ensure complete drainage of ca-MRSA related abscesses, although this is anecdotal. Furuncles less than 5cm in diameter may respond to drainage alone, but we routinely provide coverage with antibiotics, particularly if there is surrounding erythema or induration. If an abscess is large, it should be packed with a Penrose drain or with material such as iodoform gauze, and undergo daily evaluation to ensure that the abscess is not recurring.

In severe or invasive infections or in infections which do not respond quickly to the above therapies, patients should be admitted to a medical treatment facility and be treated with vancomycin or linezolid. Also, if patients present with evidence of sepsis or the systemic inflammatory response syndrome (fever, low blood pressure, tachycardia, hyperventilation, confusion) expeditious administration of vancomycin (and possibly other antibiotics) should occur. Rapid referral for hospitalization and surgical consultation should be made in these cases.

Preventive Measures

Proper hygiene remains a cornerstone for preventing transmission of this infectious illness. This involves hand washing, covering draining skin lesions, not sharing potentially contaminated items, and avoidance of crowding and close contact whenever possible. Medical providers play an important role in these measures in that they may be the first and only personnel to educate infected service members. Colonized and infected patients may be important reservoirs for ca-MRSA and contribute to the spread and recurrence of disease. It is incumbent upon medical providers in the military system to advise commanders regarding appropriate hygiene practices. Rates of colonization with ca-MRSA in various settings have suggested rates of 4 to 8% of an at-risk population, but it is unclear whether swabbing and culturing the nares is an effective way to decrease colonization and limit outbreaks.[15] However, this could be of benefit in monitoring the effectiveness of a community-based MRSA prevention program.

Reports of de-colonization with hexachlorophene or chlorhexidine gluconate with mupirocin have resulted in mixed success.[16] Anecdotally, we have seen significant reductions in ca-MRSA infections at

NSWC since providing and requiring use of 4% gluconate in barracks showers. This is used as a body wash and is enforced by inspection of barracks showers and direction by instructor staff.

While the impact of hand washing on prevention of ca-MRSA in the general population has not been evaluated, multiple studies have shown a benefit to hand washing in preventing multiple types of infectious illnesses. An increasing trend in the use of alcohol-based waterless hand cleaners has occurred. This has been due to their ease of use and some information that they may result in decreased rates of infection. Specifically, a study of alcohol-based hand cleaner in a hospital setting resulted in a 46% reduction in the number of nosocomial MRSA cases per 1000 patient-days.[17] Caution should be used in generalizing this result to a military population since hospitalized patients and healthy service members are different hosts.

Summary

Ca-MRSA is an increasingly important cause of morbidity in military populations, particularly in training settings. It is highly contagious and destructive of tissue. Skin and soft tissue involvement are the most common manifestations, but other serious illness may occur. Incision and drainage of abscesses and antibiotics for soft tissue infections are the mainstays of treatment. Several oral antibiotics are effective, but beta-lactam antibiotics such as penicillins or cephalosporins are not. A high index of suspicion for ca-MRSA is important, and patients with infections not responding to initial therapy should have wounds cultured and antibiotics changed to provide appropriate coverage. Intravenous vancomycin and hospitalization should be considered for patients with serious infection or systemic illness. Hygiene and avoiding sharing personal items are cornerstones of prevention, and use of antibacterial soaps such as chlorhexidine are also likely helpful.

CDR John S. Hammes earned is BS in Chemistry at USNA in Annapolis in 1989 and his MD at USUHS in 1993. He is board certified in Internal Medicine and Nephrology, Undersea Medical Officer trained, and is the Senior Diving Medical Officer, NSWC. CDR Hammes is currently the Medical Department Head at NSWC/BUD/S where ca-MRSA is endemic.

References

1. Hawkes M, Barton M, Conly J et al. (2007). Community-associated MRSA: Superbug at our doorstep. *Canadian Medical Association Journal*. 176(1) 54-56.
2. Kaplan SL, Hulten KG, Gonzalez BE et al. (2005). Three-year surveillance of community-acquired *Staphylococcus aureus* infections in children. *Clinical Infectious Diseases.* 40(12):1785-91.
3. King MD, Humphrey BJ, Wang YF et al. (2006). Emergence of community-acquired methicillin-resistant *Staphylococcus aureus* USA 300 clone as the predominant cause of skin and soft-tissue infections. *Annals of Internal Medicine*. 144(5) 309-317.
4. Campbell KM, Vaughn AF, Russell KL et al. (2004). Risk factors for community-associated methicillin-resistant *Staphylococcus aureus* infections in an outbreak of disease among military trainees in San Diego, California, in 2002. *Journal of Clinical Microbiology*. 42(9), 4050-4053.
5. Crum NF, Lee RU, Thornton SA, et al. (2006). Fifteen-year study of the changing epidemiology of methicillin-resistant *Staphylococcus aureus*. *The American Journal of Medicine.* 119(11) 943-951.
6. Huang H, Flynn NM, King JH et al. (2006). Comparisons of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) and hospital-associated MRSA infections in Sacramento, California. *Journal of Clinical Microbiology*. 44(7) 2423-2427.
7. Frazee BW, Salz TO, Lambert L, Perdreau-Remington F. (2005). Fatal community-associated methicillin-resistant *Staphylococcus aureus* pneumonia in an immunocompetent young adult. *Annals of Emergency Medicine*. 46(5), 401-404.
8. Moreillon P, Que Y, Glauser MP in Mandell, (2005). *Bennett & Dolin: Principles and Practice of Infectious Diseases*, 6th ed. Churchill Livingstone.
9. Johnston CP, Cooper L, Ruby W et al. (2006). Epidemiology of community-acquired methicillin-resistant *Staphylococcus aureus* skin infections among healthcare workers in an outpatient clinic. *Infection Control and Hospital Epidemiology*. 27(10) 1133-113.
10. Moellering RC. (2006). The growing menace of community-acquired methicillin-resistant *Staphylococcus aureus. Annals of Internal Medicine*. 144(5) 368-70.
11. Retrived 12 July 2007 from http://www.denka-seiken. co.jp/english/products/bacteriology/staphylococcusAureus.html.
12. Al-Shawwa BA, Wegner D. (2005). Trimethoprim-sulfamethoxazole plus topical antibiotics as therapy for acute otitis media with otorrhea caused by community-acquired methicillin-resistant *Staphylococcus aureus* in children. *Archives of Otolaryngology and Head and Neck Surgery*. 131: 782-784.
13. Cohen PR. (2005). Cutaneous community-acquired methicillin-resistant *Staphylococcus aureus* infection in participants of athletic activities. *Southern Medical Journal*. 98(6) 596-602.
14. Kowalski TJ, Berbari EF. (2005). Osmon DR. Epidemiology, treatment, and prevention of community-acquired methicillin-resistant *Staphylococcus aureus* infections. Mayo Clinic Proceedings 80(9) 1201-1208.
15. Palavecino E. (2004). Community-acquired methicillin-resistant *Staphylococcus aureus* infections. *Clinics in Laboratory Medicine* 24 403-418.
16. Simor AE, Phillips E, McGeer A et al. (2007). Randomized controlled trial of chlorhexidine gluconate for washing, intranasal mupirocin, and rifampin and doxycycline versus no treatment for the eradication of methicillin-resistant *Staphylococcus aureus* colonization. *Clinical Infectious Diseases*. 44(2):178-85.
17. Lai KK, Fontecchio S, Melvin Z, Baker S. (2006). Impact of alcohol-based, waterless hand antiseptic on the incidence of infection and colonization with methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant enterococci. *Infection Control and Hospital Epidemiology.* 27(10)1018-1021.

Traumatic Amputation of a Finger — A Stark Reminder

Al Calvillo, 18D, BHS, BS; Jeffrey L. Spivey, MPAS, PA-C

Abstract

Because service members wear rings while on military duty, the potential for undue injury to the hands and fingers of service members is increased. Therefore, it is important to be informed about how and when they occur. Soldiers wear rings while on duty because they forget to take them off, don't want to lose them, or, for marital and other varying reasons. This article will show the consequences of ring related injuries.

Rings are worn on duty without any thought to consequence until an injury occurs. The problem with ring finger avulsions is that they happen when least expected. The secondary issue with such injuries is the amount of physical and psychological stress incurred by the military service member. The answer is simply not to wear rings while on duty of any sort. Despite the amount of ring finger avulsions that have occurred to military personnel, rings have, and most likely will, continue to be used in these settings. With such little exposure, Soldiers may not be aware of the hazards of wearing rings while on duty. A continual reminder is helpful to ensure the safety of our military service members.

Ring finger avulsions/de-gloving injuries in the military are a common occurrence. Statistics are not broadcast often and the literature content is minimal. What does exist is mostly oriented toward the civilian population. The literature is almost silent concerning these types of injuries occurring in the Armed Forces population. From the start of fiscal year 2003 till January 2005, 145 finger-related accidents were reported by the U.S. Army. These consisted of Class B and C injuries.[1]

According to Army Regulation 385-40, requirements exist for reporting military on-duty injuries. The requirements are broken down into six classes -- A thru F. These "accident" classes are used to determine the appropriate investigative and reporting procedures. A *Class A* accident is when the resulting total cost of property damage is $1,000,000 or more; an Army aircraft or missile is destroyed, missing, or abandoned; or an injury and/or occupational illness results in a fatality or permanent total disability. A *Class B* accident is when the resulting total cost of property damage is $200,000 or more, but less than $1,000,000; an injury and/or occupational illness results in permanent partial disability, or when three or more personnel are hospitalized as inpatients as the result of a single occurrence. A *Class C* accident is when the resulting total cost of property damage is $20,000 or more, but less than $200,000; a nonfatal injury that causes any loss of time from_work beyond the day or shift on which it occurred; or a nonfatal occupational illness that causes loss of time from work (for example, one work day) or disability at any time (lost time case). A *Class D* accident is when the resulting total cost of property damage is $2,000 or more but less than $20,000. A *Class E* aviation incident is when the resulting damage cost and injury severity do not meet the criteria for a *Class A-D* accident ($2,000 or more damage; lost time/restricted activity case). A *Class E* aviation incident is recordable when the mission (either operational or maintenance) is interrupted or not completed. Intent for flight may or may not exist. An example of a recordable *Class E* incident is when the engine quits during a maintenance operational check (MOC). Examples of non-recordable *Class E* incidents are: chip detector light illumination and the component is not replaced, mission interrupted/aborted because of weather, unless mission is canceled; failure of fair wear and tear (FWT) items found on pre- or post-flight inspection; radio failure where radio is replaced; closing a door found open in flight. The last class is called foreign object damage (FOD) aviation incident (also known as *Class F* incident). It is described as recordable incidents confined to aircraft turbine engine damage (does not include installed aircraft Auxiliary Power Units [APU]) as a result of internal or external FOD, where that is the only damage.

Military personnel have high-risk jobs and extra precautions need to be taken to ensure the safety of service members. Local rules and regulations prohibiting the use of wedding bands (or any closed rings) in the field can normally be found in official memoranda. The reason is simple -- closed rings (such as wedding bands) can cause irreversible damage by avulsing the soft tissue, which can cause total or partial loss of a finger.

This type of injury normally occurs in a field environment, but can also occur while in garrison (e.g., in the motor pool or in the office), usually by getting the ring

caught as the service member exits a vehicle from a height. These injuries are also caused during military operations, for example when a paratrooper exits an aircraft during an airborne operation and the ring catches on the door. They happen as service members are coming in from the field tired and become lax with safety as in the case of one Ft. Hood Soldier who stated, "I'd taken my wedding band off my dog tags and slipped it back on my left-hand ring finger. I figured since training was over, wearing my ring was no big deal."[2] This well-seasoned Soldier had a system that never failed him and had brought him home with ten fingers in the past. After his accident in the motor pool, when he jumped off the back end of an LMTV (light medium tactical vehicle), he faced a decision placed on him by the doctors. They explained to him that in order to attain full recovery, amputation would be the best course of action to take.[2]

Ring finger avulsions in the civilian population also tend to occur during a jump or an exit from a height as in the case of a 17 year-old boy who jumped over a fence and sustained an avulsion injury to the fifth digit. His ring caught on the fence on his way down.[3] These injuries can have significant results, as we will discuss in this article.

Case

A 34 year-old right-hand dominant active duty female was at the local trash collection point for a detail when she dismounted a LMTV. The truck harbored a safety issue; the ladder was missing from its storage bin. Since there was no ladder, she exited the vehicle by holding onto the side rail and jumping down to the ground. This was also a safety violation. The height from the bed of the truck to the ground was approximately 4.5 feet.

As she leapt to the ground, she felt a jerking sensation in her left hand. The ring on her left index finger had caught on the side rail, and the distal one-half of the finger was still attached to the siderail. This force also avulsed the common flexor tendon to the left index finger from its origin in the proximal forearm, which the patient reported as "looking like a long piece of spaghetti" (Figures 1a and 1b). Amazingly, she felt almost no pain, most likely from the shock of realizing what had occurred. She had caused a subtotal degloving injury and partial amputation of her finger.

Figures 1 a & b

She was taken to the local military hospital by EMS. Evaluation by the ER staff showed complete degloving from the level of the proximal interphalangeal joint (PIPJ) with 90% tissue loss and exposed condyles of the proximal phalanx. There was no arterial bleeding noted (Figure 2). The common flexor tendon was still attached to the finger and hand. Radiographs showed no foreign bodies and no fracture of the left index finger proximal phalanx or metacarpal.

Figure 2

The orthopaedic on-call provider was contacted and evaluated the patient at the ER bedside. A decision was made at that time with the patient and her husband that there was very little hope of successful reattachment and that completion amputation of the left index finger and metacarpal would provide her with the best functional outcome (Figure 3). Her initial treatment in the ER consisted of copious irrigation with normal saline, pain control, IV antibiotics, and admission to the hospital for the amputation procedure.

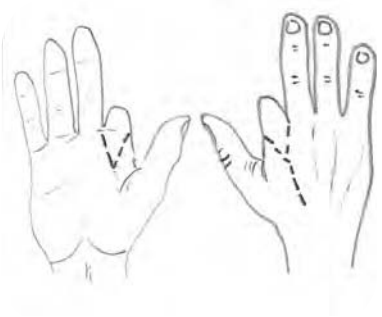


Figure 3

Operative Procedure

The operative procedure performed was a completion amputation with ray resection. In certain situations this can be considered an important functional enhancement.[4] This procedure creates a normal-appearing web space between the affected and the adjacent finger (Figures 4 and 5).[5] The main focus for this procedure is to reestablish the functional contour of the hand.[4] If the metacarpal is not resected, it can significantly compromise hand function and leave the patient with an uncomfortable

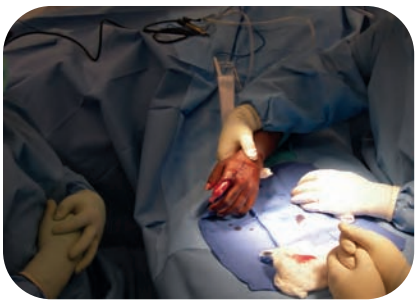


Figure 4

Figure 5

prominence of the metacarpal condyles. Care is taken during this procedure to perform a digital nerve neurectomy as proximal in the hand as possible to minimize the chances of a painful neuroma.

Figure 6

In this case, the index-ray resection was performed and the space between the middle finger and thumb was approximated and closed with deep Vicryl™, subcutaneous Vicryl™, and running nylon suture (Figures 6 and 7). The post-operative X-ray showed a successful index ray resection (Figure 8). The patient tolerated the procedure without complications and went home the same day on convalescent leave.

Figure 7

Figure 8

Results and Discussion

The patient returned for follow-up at one week post-operatively for a wound check. The patient denied experiencing any fevers, chills, or fatigue. The wound was clean and dry with no bleeding, redness, warmth, or discharge. She stated that overall she was doing fine except for some phantom pain, which she described as "bad muscle cramps in my hand." Most of her pain was in the proximal forearm near the site where the flexor tendon had avulsed.

She returned again at two weeks post-operatively for suture removal. An occupational therapy consult was ordered; the patient attended a total of 11 rehabilitation appointments before she deployed to Iraq with her unit, six weeks to the day after her injury occurred. At the time of her deployment, she reported no phantom pain, no pain with activities of daily living, and a "completely functional hand."

A revised grading system was developed by Simon Kay to measure ring avulsion injuries.[6] The system is used to relate the severity of injury with the likelihood of salvage and functional outcome. In this case, the patient was a grade IV. Studies show that this grade of injury maintains a high percentage of range of motion in the metacarpal, proximal interphalangeal, and distal inter phalangeal joints.

Kay's Classification

I	Circulation adequate w/ or w/o skeletal injury
II	Circulation inadequate (arterial and venous), no skeletal injury
III	Circulation inadequate (arterial and venous), fx or joint injury present
IV	Complete amputation or degloving

The possible sequelae of finger amputation are neuroma formation, palmar incontinence, decreased grip strength, and loss of power in both supination, pronation, and palmar narrowing (i.e., with ray-resection).[6] The goals of management are to reduce pain and swelling, prevent blood loss and infection, repair tissue, achieve a functional reduction of fractures, and provide the patient with as useful a hand as possible.

Conclusion

Finger de-gloving injuries can be functionally, cosmetically, and psychologically debilitating. They happen on the battlefield, in the motor pool or office, or when safety is disregarded and it is least expected. The potentially disastrous outcomes of finger degloving injuries from a ring should be a top safety issue for leadership at all levels. Functional loss is of particular importance, particularly in the military community. Army aviators are constantly being told to remove their rings and that no rings can be worn when involved in aviation operations.[7] One aviator, stationed in Bosnia-Herzegovina, was working as part of a quick-reaction force (QRF) UH-60 crew.. This aviator always made a habit out of taking his wedding band off before operations. On one particular occasion he forgot to take off his ring and endured a flight operation without problem. After the operation was over he dismounted his seat, took off his gloves, and noticed his ring still on. He later stated that he thought to himself "I always take that ring off; well, no point in taking it off now since I'm done flying." As he exited the aircraft door his left hand ring finger caught on a screw sticking up from a panel. Initially a section of skin tore off about a half inch long. The tear went from where the ring naturally rested to the PIPJ. Fortunately this Soldier walked away with just a couple of band-aids and no stitches. Nevertheless, he did learn from his experience and states, "Never, ever climb on an aircraft, or anything else, while wearing a ring. Take it off and forget it. It's not worth the pain."[7]

The negative impact of traumatic injuries on morale, manpower, and esprit de corps is well known. Another good

example is an Army Soldier who didn't want to wait for his buddy to lower the hydraulic lift of the tailgate of a heavy truck and decided to jump off instead. This incident occurred while in a hangar at a height of 4.5 feet. After his ring caught on the rear truck rail he later recalled stating "I grabbed what remained of my hand and ran inside the hangar for help. I was so distraught I didn't look for my missing finger."[1] This Soldier later became a successful service member when he was selected for flight school despite losing his finger. The finger loss was due to severe blood vessel and nerve damage.[1] Victims frequently become advocates of such safety concerns and make statements such as "stay alert and realize even the simplest of tasks can hurt you in a big way. If it can happen to me, it can happen to you."[2] They typically share their stories in hopes that other service members will open their eyes and, to prevent them from making the same mistake. For service members, the frustration comes in dealing with the injury and being unable to perform prescribed duties, especially on deployments.

A recently published military article described a tank commander in Iraq conducting normal M109A6 checks with his Soldiers when his wedding band caught on a protruding piece of the driver's periscope. He lost his balance and fell and the wedding band tore the skin off his finger from the PIPJ to the fingertip.[8] It's always a gamble when rings are worn on duty. For some, the physical outcome is better than for others, but the psychological impact always remains. Soldiers state that they are never the same again.

Ring finger avulsions are not a new issue in the military. Rings continue to be worn despite the obvious risk and the horrifying stories told of Soldiers losing their fingers and having their lives change. The authors wish is to communicate to all service members the dangers of wearing rings on duty.

Executive Editor Note: Compliments to Al Calvillo for a great article. We need to see more from the working class enlisted Medics. Write!

This article is dedicated to SFC Pedro Munoz.

SFC Calvillo is an 18D attending Phase II of Physician Assistant (PA) school. He is currently assigned to the Department of Emergency Medicine at Carl R. Darnall Army Medical Center, Fort Hood, TX. He joined the Army in 1995 as a combat Medic and successfully completed the 18D program in 2000. He was assigned to 7th SFG (A) and began PA training in 2005.

Mr. Spivey is retired Army. He is currently a senior staff PA at the Department of Orthopaedics and Rehabilitative Services, Carl R. Darnall Army Medical Center, Fort Hood, TX. During his military career, Mr. Spivey served as a light infantry platoon Medic, evacuation NCO, physical therapy specialist, AMEDD Center & School Instructor, and a battalion physician assistant with the 1st Cavalry Division. His awards and decorations include the CMB, EFMB, Bronze Star, MSM (2OLC), ARCOM (2 OLC), AAM (3 OLC), NDSM, GWOT Service Medal, GWOT Campaign Medal, and the Honorable Order of Saint Barbara for Field Artillerymen.

References

1. Cronrath, M. (2005, Mar). Missing something? *Countermeasures*, 26(3), 12-13
2. Melancon, D. A. (2006, Apr). This little piggy. *Countermeasures*, 27, 8-9.
3. Huemer, G. M., & Dunst, K. M. (2005, February 10). Finger avulsion with pulled-out flexor tendon. *New England Journal of Medicine*, 325(6), e5.
4. Brunicardi, C. F., Andersen, D. K., Billiar, T. R., Dunn, D. L., Hunter, J. G., Pollock, R. E. (2005). Schwartz's principles of surgery, Ch. 43, (8th ed.). : McGraw Hill Medical Publishing Division.
5. Skinner, H. B. (2006). Current Diagnosis & Treatment in Orthopoedics, p.539, (4th ed.): Lange Medical Books/McGraw-Hill.
6. McDonald, A. H., Cleland, H. J., Leung, M., & Slattery, P. G. (1999). Ring avulsion injuries. *Aust. N.Z. J. Surg*., 69, 514-516.
7. England, W. F. (2004, July). No rings, no kidding. *Flight Fax*, 23(7), 14.
8. U.S. Army CRC (2006, 10-16 Aug). Got Risk. Preliminary Loss Reports. Retrieved July 20, 2007, from http://crc.army.mil.

Rapid Reversal of Warfarin Toxicity Using Recombinant Factor VIIa in a Deteriorating Patient with Left Hemothorax

Hany Samir, MD, MBCCH; Gabriel P. Owens, PA-C, MPAS; Faisal Masud, MD, FCCP

Executive Editor's Note: The authors report a very interesting and potentially significant case. It is, however, a series of one, and not an established clinical practice to be followed. The science of factor VIIa's role is still evolving. This drug has potential for serious good and serious harm, and should not be used for off-label applications by many at this time. It begs the question: Were they good or were they lucky? Either way, they were right in publishing their case report.

Introduction

Warfarin is the most commonly prescribed anticoagulant today; however, warfarin toxicity, with resultant spontaneous hemorrhage, is a common complication of oral anticoagulation. By 24 months of warfarin treatment, the cumulative incidence of major hemorrhagic complication is 10.6%.[1] Warfarin inhibits hepatic synthesis of the coagulation factor VII. We report a case in which activated recombinant factor VIIa (rFVIIa) was used to rapidly reverse this effect, in order to promote hemostasis and perform a lifesaving tube thoracostomy for hemothorax.

Case Presentation

A 56-year-old man on warfarin 5mg (daily) presented with orthopnea and left-sided chest pain one month following thoracic aneurysm repair. During the hospitalization for aneurysm surgery, he developed a deep venous thrombosis (DVT). The patient initially presented to an outside facility with moderately severe shortness of breath exacerbated by exertion. Upon being diagnosed with a left-sided hemothorax, the patient was transferred to a tertiary care facility.

The chest examination revealed a patient in moderate-to-severe respiratory distress with some accessory muscle use. The chest X-ray showed an opacified left hemithorax, worrisome for a large left hemothorax. With the possibility of a leaking thoracic aneurysm, rapid hemostasis and normalization of the international normalized ratio (INR) was required. To avoid further respiratory compromise, and a trip to the OR, relief of the hemothorax via tube thoracostomy was our goal.

The admission prothrombin time (PT) was 46 sec with an INR of 5. Almost immediately after the intravenous administration of 4.8 mg of rFVIIa, labs were drawn. Shortly thereafter, the PT was 18 sec, with an INR of 1.4.

Once the INR was normalized, a left tube thoracostomy was performed. Approximately one liter of

bloody fluid was evacuated. The chest X-ray improved, as did the patient's respiratory status. Very little chest tube output was noted after the initial evacuation.

Hospital Course

Approximately 18 days after admission, the patient developed a pleural effusion, which required intraoperative thoracotomy, decortication, and chest tube insertion. He was discharged home in stable and improving condition one month after admission to the tertiary facility. No DVT or pulmonary embolus occurred during the hospitalization. Aspirin and clopidogrel were prescribed as DVT prophylaxis.

Discussion

A search of PubMed using "recombinant factor VIIa" and "warfarin" returned 25 articles. Upon reviewing the articles, none were found which presented a case of rFVIIa used to correct the INR and to promote hemostasis for hemothorax in a patient with warfarin toxicity. A search of PubMed using "recombinant factor VIIa," "warfarin" and "hemothorax" returned no articles.

To the authors' knowledge, this is the first reported use of rFVIIa to correct a warafain-induced coaglopathy, in order to treat hemothorax with tube thoracostomy. Historical treatment modalities of warfarin toxicity include transfusion of fresh frozen plasma (FFP) and parenteral administration of vitamin K. The FFP can lead to large intravenous volume shifts and exposes the patient to the risks of transfusion, acute pulmonary edema, and transfusion-related acute lung injury (TRALI). Vitamin K requires up to six hours to display its therapeutic benefit. In an emergent situation, with a hemodynamically unstable patient, life-saving interventions must be performed without delay.

Presently, rFVIIa is FDA-approved for use in hemophiliacs with bleeding diatheses. Extensive "off-label" use of rFVIIa in both trauma[2,3] and cardiac surgery patients[4,5] has shown promising results. The rFVIIa allowed an almost immediate correction of the INR, and the promotion of hemostasis, without the extension of DVT or creation of pulmonary embolus. Any invasive procedure performed in a hypercoagulable patient can lead to its own set of complications. In the absence of coagulopathy, lifesaving interventions can proceed with decreased risk of hemorrhagic complications. Therefore, rFVIIa has potential to be used as a rescue therapy.

However, further investigation is needed to delineate the effects of rFVIIa on patients who are not coagulopathic. Our experience with cardiovascular surgical patients is extensive, but most of these patients have either been treated with heparin in the OR, had undergone cardio-pulmonary bypass, or are taking some form of anticoagulant (aspirin, clopidogrel, warfarin, etc.). The risk of creating a hypercoagulable state after administration is not known, and requires further research.

The exact dose required to correct an elevated INR is not known at this time. There is no dosing guideline for the use of rFVIIa to correct an elevated INR. In our institution, we strive to correct the INR using the lowest dose possible. Anecdotal evidence suggests that a dose lower than 90mcg/kg may be sufficient to correct the coagulopathy. Nevertheless, further studies designed to determine proper dosing guidelines are required.

Conclusion

Life-threatening hemothorax due to warfarin toxicity can be treated rapidly with rFVIIa. The use of rFVIIa results in an almost immediate normalization of the INR, allowing for interventional procedures to be performed quickly and safely, with minimal risk of a bleeding complication. The administration of rFVIIa in the presented patient did not lead to a thromboembolic event, DVT, or pulmonary embolus.

The challenge of determining short and long-term complications to rapid normalization of INR, and possibly creating a hypercoagulable state remain. Correct dosing regimen to treat abnormal coagulation states caused by trauma, warfarin overdosage, and post-cardiac surgery coagulopathies remain to be determined.

Military Implications

Coagulopathy, whether iatrogenic or as a result of polytrauma, requires intervention to reduce mortality and morbidity. Hemothorax, though reduced by advanced body armor, is still a life threatening injury encountered on the modern battlefield. The U.S. military is the single most prolific user of Factor VIIa, and with good cause. The judicious use of this medication can reduce bleeding in coagulopathic patients. For the SOF operator, the ability to safely reverse severe, trauma-induced coagulopathies with an easily carried, single dose medication represents an ideal goal to work towards.

At this time, the adverse effects and proper dosing for such a medication have not yet been determined. It is our goal as Soldiers, providers, and academicians to solve the challenges presented by this unique drug, in order to conserve the fighting strength.

Dr. Hany Samir joined the Methodist Hospital Physician Organization, Department of Anesthesiology in July of 2005 as Assistant Professor of Critical Care Medicine and Cardiovascular Anesthesia. In 2006, he received an appointment as Assistant Professor of Clinical Anesthesiology with Weill Medical College of Cornell University. After graduating from Kasr El-Aini Medical School in Cairo, Egypt, Dr. Samir completed his residency training in anesthesiology at the New York University Medical Center. He also did a combined fellowship in cardiovascular anesthesia and critical care medicine at the NYU Medical Center. Upon completion of his fellowship, Dr. Samir joined the Baylor College of Medicine Department of Anesthesiology as Assistant Professor of Critical Care Medicine in January of 2003. As a member of BCM faculty, he dedicated himself to providing patient care in the world renowned DeBakey Heart Center at The Methodist Hospital in Houston, Texas. Dr. Samir has devoted himself to the training and teaching of tomorrow's physicians. In July 2006, he was appointed Director of Residency Education for The Methodist Hospital Department of Anesthesiology, Division of Critical Care Medicine. His leadership continues to grow the reputation of excellence that is associated with the DeBakey Heart Center and The Methodist Hospital.

MAJ Gabriel P. Owens is a graduate of the University of Nebraska. He enlisted in 1988, and completed the Special Operations Medical Sergeant Course in 1990. MAJ Owens attended the U.S. Army Physician Assistant Program, and was commissioned in 1997. He is currently assigned to a Brigade Military Transition Team as part of OIF.

Dr. Masud received his medical degree from Rawalpindi Medical College in Pakistan in 1988, earning the Presidential Gold Medal and the Best Graduate Award. He successfully completed his residency in anesthesiology at Monmouth Medical Center in New Jersey. Dr. Masud elected to further his training at Cleveland Clinic Foundation in cardiac anesthesia, followed by an additional fellowship year in critical care anesthesia at Duke University. Dr. Masud attained certification by the American Board of Anesthesiology (1996), in Critical Care (1997) and in Perioperative Transesophageal Echocardiography (2001). Dr. Masud lends his valuable talents and expertise to the education and mentoring of medical students, residents, fellows, visiting residents, and international observers. He has been the recipient of the Golden Apple Award for Excellence in Teaching four times since 1999, the Dean H. Morrow Resident Mentor Award in 2001, and the most prestigious Fulbright & Jaworski Faculty Excellence Award in Educational Leadership in 2004. Dr Masud is presently the Medical Director, Cardiovascular Intensive Care Unit, Methodist DeBakey Heart Center, and a Associate Professor of Clinical Anesthesiology at the Weill Medical College of Cornell University.

References

1. Gitter MJ, Jaeger TM, Petterson TM, et al. (1995). Bleeding and thromboembolism during anticoagulant therapy: A population-based study in Rochester, Minnesota. *Mayo Clin Proc* Aug; 70(8): 725-33[Medline].
2. Rizoli SB, Boffard KD, Riou B, Warren B, Iau P, Kluger Y, Rossaint R, Tillinger M. (2006). The NovoSeven(R) Trauma Study Group. Recombinant activated factor VII as an adjunctive therapy for bleed ing control in severe trauma patients with coagulopathy: Subgroup analysis from two randomized trials. *Crit Care.* Dec 21;10(6):R178 [Epub ahead of print] PMID: 17184516 [PubMed - as supplied by publisher].
3. Grounds RM, Seebach C, Knothe C, Paluszkiewicz P, Smith TS, Kasal E, Lecumberri R, Urbanec R, Haas T, Wujtewicz M, Rehorkova D, Pelichovska M, Lange M, Uranga M, Bosman R, Rommes JH, Koscielny J.(2006). Use of recombinant activated factor VII (Novoseven) in trauma and surgery: Analysis of out comes reported to an international registry. *J Intensive Care Med.* Jan- Feb;21(1):27-39. PMID: 16698742 [PubMed - indexed for MEDLINE].
4. Dell'Utri D, Passariello M. (2006). The use of recombinant-activated factor VII to successfully control postoperative critical bleeding after emergency repair of ruptured abdominal aortic aneurysm in a non-coagulopathic patient. *J Cardiothorac Vasc Anesth.* Aug; 20(4):570-2. Epub 2006 Feb 7. PMID: 16884992 [PubMed - indexed for MEDLINE].
5. Walsham J, Fraser JF, Mullany D, Ziegenfus M, Chinthamuneedi M, Dunning J, Tesar P. (2006). The use of recombinant activated factor VII for refractory bleeding post complex cardiothoracic surgery. *Anaesth Intensive Care.* Feb; 34(1):13-20. PMID: 16494143 [PubMed - indexed for MEDLINE].

Continuing Medical Education Test

Transfusion Medicine

JSOM

1) During storage, red blood cells undergo changes which are detrimental to their oxygen carrying capacity. These changes include all of the following EXCEPT:
   a. Loss of cytoskeletal proteins resulting in loss of biconcave shape
   b. Loss of integral membrane components which limits deformability
   c. Increase in cellular ATP stores resulting in decreased cellular adhesion
   d. Conversion of hemoglobin to methemoglobin which is incapable of carrying oxygen

2) Even after removal of other components of whole blood during the production of packed red blood cells (pRBCs), multiple active compounds remain in pRBCs which may decrease the effectiveness of transfusion. All of the following remain in pRBCs EXCEPT:
   a. Platelets
   b. Histamine
   c. Cytokines
   d. Lipids

3) Which level of normovolemic anemia has been shown to be compatible with normal organ function in healthy individuals?
   a. 1g/dL
   b. 2g/dL
   c. 2.5g/dL
   d. 5g/dL

4) All of the following have been shown to be associated with the use of transfusion in clinical trials, EXCEPT:
   a. Increased mortality
   b. Increased rate of infection
   c. Decreased length of hospital stay
   d. Multiple organ system failure

5) One prospective cohort study of trauma patients showed that blood older than _____ days was an independent risk factor for post-injury infection.
   a. 5
   b. 7
   c. 9
   d. 14

6) All of the following are risks associated with the use of whole blood transfusion EXCEPT:
   a. Increased oxygen carrying capacity
   b. Transmission of Hepatitis C
   c. Transfusion reactions
   d. Transmission of HIV

7) Although still experimental, blood substitutes would provide several advantages including:
   a. Decreased tissue oxygenation
   b. Suppression of the human immune response
   c. Increased storage life
   d. Increase in transfusion reactions

8) Far-forward transfusion should be considered in which of the following patients?
   a. Hypotensive patient with uncontrolled extremity hemorrhage
   b. Normotensive patient with an abdominal gunshot wound and normal mental status after 250cc bolus of hetastarch (Hextend®)
   c. Hypotensive patient with bleeding from an uncontrolled site (abdomen/thorax) and altered mental status
   d. Hypotensive patient with extremity hemorrhage controlled with a tourniquet prior to fluid resuscitation

9) While transfusing a patient with pRBCs, he develops fever, chills, and back pain, and his pulse increases from 124 to 156bpm. You should immediately:
   a. Give diphenhydramine (Benadryl®)
   b. Inject epinephrine 0.3 - 0.5mg subcutaneously
   c. Stop the transfusion
   d. Continue the transfusion and bolus with 500cc NS

10) Acute transfusion reactions which may be seen in the field include all of the following EXCEPT:
   a. Type-incompatible hemolytic reactions
   b. Allergic reactions
   c. Febrile reactions
   d. Graft versus host disease

Continuing Medical Education Test

Community Acquired Methicillin Resistant

Staphylococcus Aureus

JSOM

1) Which of the following locations is the most common site for infection with ca-MRSA?
   a. Urine
   b. Lung
   c. Skin and soft tissues
   d. Pharynx

2) Ca-MRSA is typically sensitive to all but which of the following antibiotics?
   a. Rifampin
   b. Cephalexin
   c. Minocycline
   d. Trimethoprim-Sulfamethoxazole

3) A patient with 2cm x 3cm tender subcutaneous swelling and surrounding erythema presents to your aid station. You suspect a ca-MRSA. In addition to treatment with antibiotics, how should the condition be treated?
   a. Ice and elevation twice daily
   b. Hydrocortisone 5% applied to the affected area
   c. Compression dressing
   d. Incision and drainage of any fluctuant area

4) Which of the following are risk factors for acquiring a ca-MRSA infection?
   a. Being incarcerated
   b. Participating in high school athletics
   c. Being elderly (>65 years of age)
   d. a and b
   e. none of the above

5) Rifampin is a drug with good activity against ca-MRSA. Select a common side effect about which patients should be counseled:
   a. Pitting of finger and toe nail surfaces
   b. High output cardiac failure
   c. Constipation
   d. Orange discoloration of urine

6) If a patient is unable to take medication by mouth or they are critically ill and you suspect ca-MRSA, an appropriate choice for therapy is:
   a. Intravenous vancomycin
   b. Intramuscular streptomycin
   c. Intravenous ticarcillin/clavulanic acid
   d. Neomycin per rectum

7) You are asked to advise your commanding officer on a recent outbreak of ca-MRSA at your unit. 15 out of 170 personnel have been affected. Which of the following recommendations should be made?

a. Discontinue all training and operations until the outbreak is resolved
b. Advise strict adherence to proper hygiene (hand washing, cleaning of wetsuits, uniforms, and linens)
c. Mass antibiotic prophylaxis with Septra
d. Issuance of antibacterial soap such as chlorhexidine gluconate or hexachlorophene with instructions on use
e. All of the above
f. b and d

8) One of your junior medics is evaluating an operator with an abscess. He asks you whether he should culture the patient's wound. The best response is:

a. There is no point in culturing it because you will give antibiotics regardless.
b. Culturing the wound will confirm the causative microbe, help to identify outbreaks in a timely fashion, and may cause you to change antibiotic therapy.
c. Abscesses are usually poly-microbial, so culturing it will not provide useful information.
d. He should not expose himself to ca-MRSA, as it is highly contagious and nearly impossible to eradicate.

9) True or false: There have been reports of resistance to clindamycin among methicillin resistant *Staphylo coccus aureus* isolates in United States military treatment facilities

a. True
b. False

10) True or false: Oral linezolid is not an effective drug for treating MRSA infections

a. True
b. False

11) You are evaluating an airman with ca-MRSA who asks you whether this will come back after he is treated. You should respond:

a. Ca-MRSA infection induces immunity and it should not recur after treatment.
b. Infection with ca-MRSA is lifelong and he should expect this to be a recurrent problem.
c. Ca-MRSA is treatable but often recurs unless aggressive preventive measures are taken to eradicate it.

If you are a physician, PA, or nurse, send in the Uniformed Services University of the Health Sciences (USUHS) Evaluation Form with your test. If you are a Medic, Corpsman, or PJ, please send the SOCOM Evaluation Form with your test.

USUHS Continuing Education Evaluation Form
Journal of Special Operations Medicine
Volume 7, Edition 3 / Summer 07
Date of Original Release Sep 07

Articles

1. **Transfusion Medicine**
2. **Community Acquired Methicillin Resistant *Staphylococcus Aureus***

3 - Agree **2 - Neutral** **1- Disagree**

	Article 1	Article 2
Educational Value:	**3 2 1**	**3 2 1**
I learned something new that is important.	_ _ _	_ _ _
I verified some important information.	_ _ _	_ _ _
I plan to discuss this information with colleagues.	_ _ _	_ _ _
I plan to seek more information on this topic.	_ _ _	_ _ _
Readability Feedback:		
I understood what the authors were trying to say.	_ _ _	_ _ _
Overall, the presentation of the article enhanced my ability to read and understand it.	_ _ _	_ _ _
Were the educational objectives of the article(s) met? If no, please explain:	Yes___No___	Yes___No___
Do you think that the article(s) unduly emphasized one company's products? Comments:	Yes___No___	Yes___No___

_____

_____

_____

_____

_____

_____

How long did it take to complete **Articles 1?**____ minutes **Articles 2?**____ minutes

What changes will you make in your practice as a result of reading the article(s)?

_____

_____

_____

_____

_____

Print Name: _____

I hereby certify that I have read the article(s) of the activity identified above and am eligible to claim credit.

Signature:_____

Date:_____

USUHS Continuing Education Evaluation Form
Journal of Special Operations Medicine, Volume 7, Edition 3 / Summer 07

Date of original release: Sep 07
Expiration Date: Sep 08

Certificates: Certificates will be mailed. Please allow up to 4 weeks for delivery.
Physicians and Nurses: Read the article designated for continuing education credit. Complete the Continuing Education Evaluation Exam and Post-test, providing correct responses to at least 80% of the questions and evaluation. Fax or mail the Post-test and the Continuing Education Evaluation Form to:

USSOCOM-SG
Attn: Maj Michelle DuGuay Landers
United States Special Operations Command
7701 Tampa Point Blvd.
MacDill AFB, FL 33621-5323
Phone # Comm: (813) 826-5442; DSN 299; Fax # -2568

ACCREDITATION/DESIGNATION STATEMENTS

CME: This activity has been planned and implemented in accordance with the essential areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Uniformed Services University of the Health Sciences (USUHS) and the Journal of Special Operations Medicine.

USUHS designates Article 1 **Transfusion Medicine** by Dan Mosely, MD; Rob Kacprowicz, MD; Troy Johnson, MD, and Article 2 **Community Acquired Methicillin Resistant *Staphylococcus Aureus*** by John S. Hammes, MD, **COMBINED** for a maximum of **1.7 *AMA PRA Category 1 Credit(s)*™**. Physicians should only claim credit commensurate with the extent of their participation in the activity.

CNE: The Uniformed Services University of the Health Sciences (USUHS) is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

1.7 CNE contact hours are provided for participation in Article 1 and Article 2 **COMBINED**.

Transfusion Medicine

1. A. B. C. D.
2. A. B. C. D.
3. A. B. C. D.
4. A. B. C. D.
5. A. B. C. D.
6. A. B. C. D.
7. A. B. C. D.
8. A. B. C. D.
9. A. B. C. D.
10. A. B. C. D.

Community Acquired Methicillin Resistant *Staphylococcus Aureus*

1. A. B. C. D.
2. A. B. C. D.
3. A. B. C. D.
4. A. B. C. D. E.
5. A. B. C. D.
6. A. B. C. D.
7. A. B. C. D. E. F.
8. A. B. C. D.
9. TRUE FALSE
10. TRUE FALSE
11. A. B. C.

NAME:_____EMAIL ADDRESS: _____
DISCIPLINE: ___PHYSICIAN ___NURSE ___OTHER_____
MAILING ADDRESS: _____

FOLD ALONG THIS LINE

UNITED STATES SPECIAL OPERATIONS COMMAND
ATTN: SOCS-SG
7701 TAMPA POINT BLVD
MACDILL AFB, FL 33621-5323
OFFICIAL BUSINESS

HQ USSOCOM/ SOCS-SG
ATTN: JSOM EDITOR
7701 TAMPA POINT BLVD
MACDILL AFB, FL 33621-5323

FOLD ALONG THIS LINE

USSOCOM Enlisted Personnel CME

Journal of Special Operations Medicine
Volume 7, Edition 3 / Summer07

Date of original release: Sep 07
Expiration Date: Sep 08
Certificates will be mailed quarterly.
Please notify JSOM if you need it sooner.

Enlisted Medical Personnel: After reading the CME designated articles, complete the tests for continuing education hours and send them in with this Continuing Education Evaluation Form. Please make a copy of this Evaluation Form for each article submitted and circle corresponding article title below. Fax or mail them to:

Attn: SOCS/SG Maj Michelle DuGuay Landers
JSOM CME
United States Special Operations Command
7701 Tampa Point Blvd.
MacDill AFB, FL 33621-5323
Phone: Comm: (813) 828-5442; DSN 299; Fax # -2568

CME Articles:

1. **Transfusion Medicine**
2. **Community Acquired Methicillin Resistant *Staphylococcus Aureus***

	3 - Agree	**2 - Neutral**	**1- Disagree**
	Article 1	**Article 2**	
Educational Value:	3 2 1	3 2 1	
I learned something new that is important.	_ _ _	_ _ _	
I verified some important information.	_ _ _	_ _ _	
I plan to discuss this information with colleagues.	_ _ _	_ _ _	
I plan to seek more information on this topic.	_ _ _	_ _ _	
Readability Feedback:			
I understood what the authors were trying to say.	_ _ _	_ _ _	
Overall, the presentation of the article enhanced my ability to read and understand it.	_ _ _	_ _ _	
Were the educational objectives of the article(s) met?	YES___NO___	YES___NO___	

If no, please explain:_____

_____

Do you think that the article(s) unduly emphasized one company's products? YES___NO___ YES___NO___

Comments:

_____

_____

_____

How long did it take to complete Articles 1 &/or 2? ____ minutes

What changes will you make in your practice as a result of reading the article?

_____

_____

I hereby certify that I have read the article(s) of the activity identified above and am eligible to claim credit.

Print Name: _____
Signature:_____
Rank: _____Date:_____

USSOCOM Enlisted Personnel CME

Journal of Special Operations Medicine
Volume 7, Edition 3 / Summer07

Date of original release: Sep 07
Expiration Date: Sep 08

Certificates: Certificates will be mailed. Please allow up to 4 weeks for delivery.
USSOCOM Enlisted Medical Personnel: Read the article designated for continuing education credit. Complete the Continuing Education Exam and Evaluation form. You must provide correct responses to at least 80% of the questions and evaluation. Fax or mail the Exam and the Continuing Education Evaluation Form to:

USSOCOM-SG
Attn: Maj Michelle DuGuay Landers
United States Special Operations Command
7701 Tampa Point Blvd.
MacDill AFB, FL 33621-5323
Phone # Comm: (813) 826-5442; DSN 299; Fax # -2568

Accreditation/Designation Statements

CME: USSOCOM designates Article 1 **Transfusion Medicine** by Dan Mosely, MD; Rob Kacprowicz, MD; and Troy Johnson, MD, and Article 2 **Community Acquired Methicillin Resistant *Staphylococcus Aureus*** by John S. Hammes, MD, **COMBINED** for a maximum of **1.7 CME.**

Transfusion Medicine

1. A. B. C. D.
2. A. B. C. D.
3. A. B. C. D.
4. A. B. C. D.
5. A. B. C. D.
6. A. B. C. D.
7. A. B. C. D.
8. A. B. C. D.
9. A. B. C. D.
10. A. B. C. D.

Community Acquired Methicillin Resistant *Staphylococcus Aureus*

1. A. B. C. D.
2. A. B. C. D.
3. A. B. C. D.
4. A. B. C. D.
5. A. B. C. D. E.
6. A. B. C. D.
7. A. B. C. D.
8. A. B. C. D. E. F.
9. A. B. C. D.
10. True False
11. True False
12. A. B. C. D.
13. A. B. C.

NAME:_____ EMAIL ADDRESS: _____
DISCIPLINE: ___PHYSICIAN ___NURSE ___OTHER_____
MAILING ADDRESS: _____
_____

JOURNAL OF SPECIAL OPERATIONS COMMAND READERSHIP SURVEY

The JSOM staff wants to get your feedback so we can better meet your needs. Our goal is to constantly improve the quality of this publication. Your feedback is critical in order for us to meet our goal. Please take a few minutes to fill out this survey and mail it to the address provided on the reverse side or fax it to DSN 299-2568 or commercial (813) 826-2568. Feel free to make copies of this survey and give them to everyone in your unit or office. E-mail: JSOM@socom.mil

Name:_____E-mail:_____
Branch of Service:_____Rank:_____Years in Service:_____Career Field:_____

(Please use the scale to rank the following statements)

Poor	Fair	Satisfactory	Good	Excellent
1	2	3	4	5

How do you rate the Journal of Special Operations Medicine (JSOM)? _____
How do you rate the JSOM overall readability? _____
How do you rate the layout of this journal? _____
How do you rate the quality of the articles? _____
How do you rate the variety of articles? _____
How do you rate the usefulness in enhancing your SOF medical knowledge/awareness?

How much of the issue do you usually read?

Cover-to-Cover	75%	50%	25%	Less

What is your favorite section of the JSOM? (Circle one)

Departments	Component Surgeon Offices	Education & Training
Features	Research & Development	Legacy
There I was	Correspondence	Editorials
SOMA Update	Photo Gallery	Med Quiz
Dedication		

What is your least favorite section of the JSOM? (Circle one)

Departments	Component Surgeon Offices	Education & Training
Features	Research & Development	Legacy
There I was	Correspondence	Editorials
SOMA Update	Photo Gallery	Med Quiz
Dedication		

What improvements would you make to the JSOM?

_____
_____
_____
_____

FOLD ALONG THIS LINE

UNITED STATES SPECIAL OPERATIONS COMMAND
ATTN: SOCS-SG
7701 TAMPA POINT BLVD
MACDILL AFB, FL 33621-5323
OFFICIAL BUSINESS

HQ USSOCOM/ SOCS-SG
ATTN: JSOM EDITOR
7701 TAMPA POINT BLVD
MACDILL AFB, FL 33621-5323

FOLD ALONG THIS LINE

Abstracts from Current Literature

Motion Sickness: Advances in Pathogenesis, Prediction, Prevention, and Treatment

Shupak, Avi; Gordon, Carlos R.

Aviation, Space, and Environmental Medicine, Volume 77, Number 12, December 2006, pp. 1213-1223(11). Publisher: Aerospace Medical Association

Abstract

Motion sickness has a major influence on modern traveling activities and the rapidly spreading engagement in virtual reality immersion. Recent evidence emphasizes the role of the otoliths in the pathogenesis of motion sickness, and several new theories may help explain its occurrence beyond the traditional sensory conflict theory. A promising new direction is the recently reported association of genetic polymorphism of the alpha2-adrenergic receptor with increased autonomic response to stress and motion sickness. Various physiological measures for the evaluation and prediction of motion sickness have been tested. However, no single parameter has yet been found to be of high enough sensitivity and specificity for the diagnosis or prediction of individual motion sickness susceptibility. A number of pharmacological and non-pharmacological countermeasures are used for the prevention and treatment of motion sickness. The non-pharmacological options include all procedures that reduce conflicting sensory input, accelerate the process of multi-sensory adaptation, and promote psychological factors which enable the subject to cope with his/her condition. The most effective anti-motion sickness drugs are central acting anticholinergics and H_1 antihistamines; however, adverse effects on psychomotor performance may limit their use in drivers, pilots, and naval crewmembers. Recent studies may be relevant to our understanding of the link between motion sickness, migraine, vertigo, and anxiety. Based on these findings and on recent neurochemical data, the development of new anti-motion sickness agents is a promising field of investigation.

Alertness Management in Aviation Operations: Enhancing Performance and Sleep

Rosekind, Mark R.; Gregory, Kevin B.; Mallis, Melissa M.

Aviation, Space, and Environmental Medicine, Volume 77, Number 12, December 2006, pp. 1256-1265(10). Aerospace Medical Association

Abstract

Introduction: Fatigue is an acknowledged safety risk in diverse operational settings. As a result, there has been growing interest in developing and implementing activities to improve alertness, performance, and safety in real-world operations where fatigue is a factor. **Methods:** A comprehensive Alertness Management Program (AMP) that included education, alertness strategies, scheduling, and healthy sleep was implemented in a commercial airline. An operational evaluation was conducted with 29 flight crewmembers, first when flying a standard schedule without AMP components (i.e., standard condition) compared with full AMP implementation, which included flying an innovative schedule that incorporated physiological sleep and alertness principles (i.e., intervention condition). The evaluation included objective measures of sleep quantity (actigraphy), psychomotor vigilance task (PVT) performance, and subjective reports of daily activities and sleep. **Results:** The results showed that the 3.5-h educational CD improved pre-education test scores from an average 74% correct to a post-education average of 98%. Alertness strategies showed minimal changes, though the daily diary did not allow for refined evaluation of duration, frequency, and timing of use. The intervention condition was associated with significantly more sleep (1 h, 9 min; $p < 0.01$) during the trip period compared with the standard schedule. All performance metrics showed significantly better performance during the intervention condition trip schedule ($p < 0.01$) compared with the standard condition. **Discussion:** This first-ever evaluation of a comprehensive AMP showed significantly improved knowledge, support for the use of alertness strategies, and increased sleep and performance during actual operations. The robust and consistent findings support the use of an AMP approach to effectively manage fatigue in operational settings.

Management of Victims in a Mass Casualty Incident Caused by a Terrorist Bombing: Treatment Algorithms for Stable, Unstable, and In Extremis Victims

Alfici, Ricardo; Ashkenazi, Itamar; Kessel, Boris
Military Medicine, Dec 2006 Vol 171 Number 12

ABSTRACT
Bombs aimed at civilian populations are the most common weapon used by terrorists throughout the world. Over the last decade, we have been involved in the management of more than 20 mass casualty incidents, most of which were caused by terrorist bombings. Commonly, in these events, there may be many victims and many deaths. However, only a few of the survivors will suffer from life-threatening injuries. Appropriate and timely treatment may impact their survival. Due to the complex mechanism of injury seen in these scenarios, treatment of victims injured by explosions is somewhat different from that exercised in blunt and penetrating trauma from other causes. The intention of this article was to outline the initial medical treatment of the injured victim arriving at the emergency department during a mass casualty incident caused by a terrorist bombing. Treatment protocols for stable, unstable, and in extremis patients are presented.

The Remote Diagnosis of Malaria Using Telemedicine or E-Mailed Images

Mody, Rupal M; Murray, Clinton K; Dooley, David P; Hospenthal, Duane R; Et al.
Military Medicine, Dec 2006 Vol 171 Number 12

ABSTRACT
We determined the ability of blinded remote expert microscopy to identify malaria parasites through transmission of malaria smear images via telemedicine and as e-mail attachments. Protocols for malaria smear transmission included: (1) transmission of sender-selected televised smears at various bandwidths (Bw), (2) transmission of remote reader-directed televised smears at various Bw, and (3) transmission of digital photomicrographs as e-mail attachments. Twenty (14%) of 147 sender-selected, and 13 (6%) of 221 reader-directed, images were deemed unreadable by slide readers. The presence or absence of malaria was correctly identified in 98% of the remaining images. Sixty-four (34%) of 190 digital microphotographs were deemed unreadable, while the presence or absence of malaria was correctly identified in 100% of the remaining images. Correct speciation ranged from 45% to 83% across various transmission methods and Bw. The use of telemedicine and e-mail technology shows promise for the remote diagnosis of malaria.

A Tuberculosis Event on a Navy Assault Ship

Foote, Frederick O'Donnell
Military Medicine, Dec 2006 Vol 171 Number 12

ABSTRACT
A tuberculosis event occurred on a U.S. Navy amphibious assault ship in September 2003. The event was signaled by a jump in monthly purified protein derivative positivity rates. A baseline new reactor rate of 0 to 1% suddenly jumped to 6.3%, prompting screening of the entire crew and embarked Marines. Ultimately, a total of 31 Navy and 17 Marine new reactors were identified. This represented 2.4% of the Navy crew and 1.2% of embarked Marines. Only 1 of 31 Navy cases involved an officer. Two Navy, male, enlisted berthing areas showed a statistically significantly increased odds ratio for infection risk. Despite intensive investigation, no active case of tuberculosis was ever identified. After treatment of new reactors with isoniazid, the ship's monthly new reactor rate returned to baseline. This case illustrates the principles and pitfalls of respiratory disease control at sea.

Deaths of Detainees in the Custody of US Forces in Iraq and Afghanistan From 2002 to 2005

Scott A. Allen, MD; Josiah D. Rich, MD, MPH; Robert C. Bux, MD; Bassina Farbenblum; Matthew Berns; Leonard Rubenstein

Medscape General Medicine. 2006;8(4):46. ©2006 Medscape
Posted 12/05/2006 Retrieved 8 Jan 07.

Abstract

In light of the large number of detainees who continue to be taken and held in U.S. custody in settings with limited judicial or public oversight, deaths of detainees warrant scrutiny. We have undertaken the task of reviewing all known detainee deaths between 2002 and early 2005 based on reports available in the public domain. Using documents obtained from the Department of Defense through a Freedom of Information Act request, combined with a review of anecdotal published press accounts, 112 cases of death of detainees in United States custody (105 in Iraq, 7 in Afghanistan) during the period from 2002 to early 2005 were identified. Homicide accounted for the largest number of deaths (43) followed by enemy mortar attacks against the detention facility (36). Deaths attributed to natural causes numbered 20. Nine were listed as unknown cause of death, and 4 were reported as accidental or natural. A clustering of 8 deaths ascribed to natural causes in Iraq in August 2003 raises questions about the adequacy and availability of medical care, as well as other conditions of confinement that may have had an impact on the mortality rate.

Admission Physiology Criteria After Injury on the Battlefield Predict Medical Resource Utilization and Patient Mortality

Eastridge, Brian J. MD; Owsley, Jimmie MD; Sebesta, James MD; Beekley, Alec MD; Wade, Charles PhD; Wildzunas, Robert PhD; Rhee, Peter MD; Holcomb, John MD

Journal of Trauma-Injury Infection & Critical Care. 61(4):820-823, October 2006.

Abstract

Background: Medical resources and resource allocation including operating room and blood utilization are of prime importance in the modern combat environment. We hypothesized that easily measurable admission physiologic criteria and injury site as well as injury severity calculated after diagnostic evaluation or surgical intervention, would be strongly correlated with resource utilization and in theater mortality outcomes. **Methods:** We retrospectively reviewed the Joint Theater Trauma Registry for all battlefield casualties presenting to surgical component facilities during Operation Iraqi Freedom from January to July 2004. Data were collected from the composite population of 1,127 battlefield casualty patients with respect to demographics, mechanism, presentation physiology (blood pressure, heart rate, temperature), base deficit, admission hematocrit, Glasgow Coma Score (GCS), Injury Severity Score (ISS), operating room utilization, blood transfusion, and mortality. Univariate and multivariate analyses were conducted to determine the degree to which admission physiology and injury severity correlated with blood utilization, necessity for operation, and acute mortality. **Results:** Univariate analysis demonstrated a significant ($p < 0.05$) association between hypothermia (T <34[degrees]C) and the subsequent requirement for operation and mortality. In addition, the outcome variable total blood product utilization was significantly correlated with base deficit ($r = 0.61$), admission hematocrit ($r = 0.51$), temperature ($r = 0.47$), and ISS ($r = 0.54$). Using multiple logistic regression techniques, blood pressure, GCS, and ISS together demonstrated a significant association ($p < 0.05$) with mortality (area under ROC curve = 95%). Multiple linear regression established that blood pressure, heart rate, temperature, hematocrit, and ISS had a collective significant effect ($p < 0.05$) on total blood product utilization explaining 67% of the variance in this outcome variable. **Conclusion:** Admission physiology and injury characteristics demonstrate a strong capacity to predict resource utilization in the contemporary battlefield environment. In the future, such predictive yield could potentially have significant implications for triage and medical logistics in the resource constrained environment of war and potentially in mass casualty and disaster incidents in the civilian trauma setting which will likely have mechanistic similarity with war related injury.

Marine with Malaria on Terminal Leave after Deployments to Iraq and Liberia

O'Donnell, Robert, Fifer, Gordon; Thurston, Donald; Malakooti, Mark; Bohnker, Bruce
Military Medicine, Dec 2006 Vol 171 Number 12

ABSTRACT

A case report is presented for a 22-year-old male Marine who developed clinical symptoms of malaria while on terminal leave. His exposure history has included operational deployments to Liberia and Iraq. His care was complicated by his terminal leave status, which required detailed coordination with civilian providers as well as military authorities.

Tactical Surgical Intervention With Temporary Shunting of Peripheral Vascular Trauma Sustained During Operation Iraqi Freedom: One Unit's Experience

Chambers, Lowell W. MD; Green, D J. MD; Sample, Kenneth MD; Gillingham, Bruce L. MD; Rhee, Peter MD, MPH; Brown, Carlos MD; Narine, Nalan MD; Uecker, John M. MD; Bohman, Harold R. MD
Journal of Trauma-Injury Infection & Critical Care. 61(4):824-830, October 2006.

ABSTRACT

Background: Rapidly restoring perfusion to injured extremities is one of the primary missions of forward military surgical teams. The austere setting, limited resources, and grossly contaminated nature of wounds encountered complicates early definitive repair of complex combat vascular injuries. Temporary vascular shunting of these injuries in the forward area facilitates rapid restoration of perfusion while allowing for deferment of definitive repair until after transport to units with greater resources and expertise. **Methods:** Standard Javid or Sundt shunts were placed to temporarily bypass complex peripheral vascular injuries encountered by a forward U.S. Navy surgical unit during a six month interval of Operation Iraqi Freedom. Data from the time of injury through transfer out of Iraq were prospectively recorded. Each patient's subsequent course at continental U.S. medical centers was retrospectively reviewed once the operating surgeons had returned from deployment. **Results:** Twenty-seven vascular shunts were used to bypass complex vascular injuries in twenty combat casualties with a mean injury severity score of 18 (range 9-34) and mean mangled extremity severity score of 9 (range 6-11). All patients survived although three (15%) ultimately required amputation for nonvascular complications. Six (22%) shunts clotted during transport but an effective perfusion window was provided even in these cases. **Conclusion:** Temporary vascular shunting appears to provide simple and effective means of restoring limb perfusion to combat casualties at the forward level.

Simulation Training for a Mass Casualty Incident: Two-Year Experience at the Army Trauma Training Center

King, David R. MD; Patel, Mayur B. MD; Feinstein, Ara J. MD, MPH; Earle, Steven A. MD; Topp, Raymond F. MD; Proctor, Kenneth G. PhD
Journal of Trauma-Injury Infection & Critical Care. 61(4):943-948, October 2006.

ABSTRACT

Background: Civilian and military mass casualty incidents (MCI) are an unfortunate reality in the 21st century, but there are few situational training exercises (STX) to prepare for them. To fill this gap, we developed a MCI STX for U.S. Army Forward Surgical Teams (FST) in conjunction with the U.S. Army Trauma Training Center. **Methods:** After a standardized briefing, each FST has 60 minutes to unpack, setup, and organize a standard equipment cache into an emergency room, operating room, and intensive care unit. In an adjacent room, five anesthetized swine are prepared with standardized, combat-relevant injuries. The number and acuity of the total casualties are unknown to the FST and arrive in waves and without warning. A realistic combat environment is simulated by creating resource limitations, power outages, security breaches, and other stressors. The STX concludes when all casualties have died or are successfully treated. FSTs complete a teamwork self-assessment card, while staff and FST surgeons evaluate organization, resource allocation, communication, treatment, and overall performance. Feedback

from each FST can be incorporated into an updated design for the next STX. **Results:** From 2003-2005, 16 FSTs have completed the STX. All FSTs have had collapses in situational triage, primary/secondary surveys, and/or ATLS principles (basic ABCs), resulting in approximately 20% preventable deaths. **Conclusions:** We concluded (1) a MCI can overwhelm even combat-experienced FSTs; (2) adherence to basic principles of emergency trauma care by all FST members is essential to effectively and efficiently respond to this MCI; (3) by prospectively identifying deficiencies, future military or civilian performance during an actual MCI may be improved; and (4) this MCI STX could provide a template for similar programs to develop, train, and evaluate civilian surgical disaster response teams.

The Eradication of Polio — Progress and Challenges

Mark A. Pallansch, PhD, and Hardeep S. Sandhu, MD
The New England Journal of Medicine Volume 355:2508-2511 December 14, 2006 Number 24 pg 2508

EXTRACT

Six years after the original 2000 target date for the global eradication of polio, public health workers are encountering several stumbling blocks. Poliovirus circulation persists in countries where the virus is endemic; new outbreaks are occurring in previously polio-free areas, including, most recently, Kenya's first documented wild-type poliovirus infection in 22 years; and complex social challenges stand in the way of public health efforts in some countries. Since 1988, when the World Health Assembly adopted the goal of eradication, the public health initiative has made extraordinary progress: the disease burden has been reduced by more than 99%, and the number of countries with endemic transmission has been reduced by more than 96%.

Acromegaly

Shlomo Melmed, MB, ChB
The New England Journal of Medicine, Volume 355:2508-2511 December 14, 2006 Number 24 pg 2558

EXTRACT

Pituitary tumors account for about 15% of primary intracranial neoplasms.[1] Given the critical location of the gland, expanding tumors cause compressive symptoms. Furthermore, as pituitary cells secrete hormones, the proliferation of these cells may lead to a spectrum of endocrine symptoms. When tumors arise in pituitary somatotroph cells, aberrant secretion of growth hormone leads to the distinctive features of acromegaly. Understanding the development, function, and regulation of somatotroph cells provides insight into the cellular origin of this tumor, as well as approaches to the treatment of acromegaly. This review discusses advances in the understanding and treatment of acromegaly.

Designing Resistance Training Programmes to Enhance Muscular Fitness: A Review of the Acute Programme Variables

Bird, Stephen P; Tarpenning, Kyle M; Marino, Frank E
Sports Medicine. 35(10):841-851, 2005.

ABSTRACT

The popularity of resistance training has grown immensely over the past 25 years, with extensive research demonstrating that not only is resistance training an effective method to improve neuromuscular function, it can also be equally effective in maintaining or improving individual health status. However, designing a resistance training programme is a complex process that incorporates several acute programme variables and key training principles. The effectiveness of a resistance training programme to achieve a specific training outcome (i.e., muscular endurance, hypertrophy, maximal strength, or power) depends on manipulation of the acute programme variables, these include: (i) muscle action; (ii) loading and volume; (iii) exercise selection and order; (iv) rest periods; (v) repetition velocity; and (vi) frequency. Ultimately, it is the acute programme variables, all of which affect the degree of the resistance training stimuli, that determine the magnitude to which the neuromuscular, neuroendocrine, and musculoskeletal systems adapt to both acute and chronic resistance exercise. This article reviews the available research that has examined the application of the acute programme variables and their influence on exercise performance and training adaptations. The concepts presented in this article represent an important approach to effective programme design. Therefore, it is essential for those involved with the prescription of resistance exercise (i.e. strength coaches, rehabilitation specialists, exercise physiologists) to acquire a fundamental understanding of the acute programme variables and the importance of their practical application in programme design.

Resistance Training for Health and Performance

William J. Kraemer; Nicholas A. Ratamess; Duncan N. French
Current Sports Medicine Reports; Volume 1, Number 3 / May, 2002.
The Human Performance Laboratory, Department of Kinesiology, Unit1110, The University of Connecticut, 06269-1110 Storrs, CT, USA

ABSTRACT

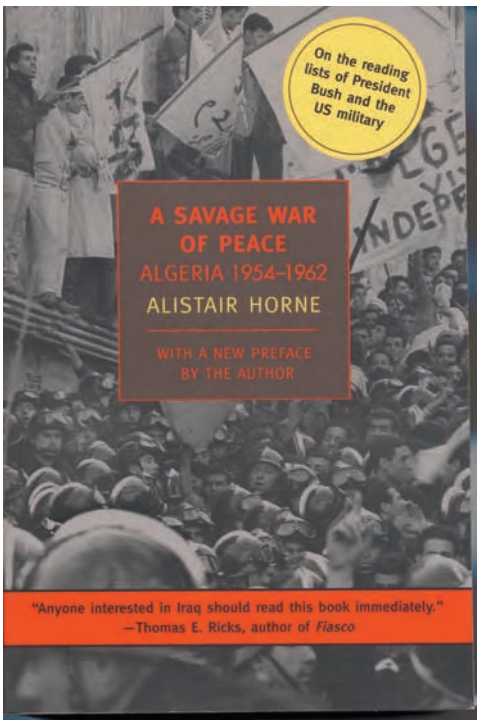
Resistance training is recommended by national health organizations for incorporation into a comprehensive fitness program that includes aerobic and flexibility exercise. Its potential benefits on health and performance are numerous; it has been shown to reduce body fat, increase basal metabolic rate, decrease blood pressure and the cardiovascular demands to exercise, improve blood lipid profiles, glucose tolerance, and insulin sensitivity, increase muscle and connective tissue cross-sectional area, improve functional capacity, and relieve low back pain. Many improvements in physical function and athletic performance are associated with the increases in muscle strength, power, endurance, and hypertrophy observed during resistance training. The key element to effective resistance training is supervision by a qualified professional and the proper prescription of the program variables. Proper program design, i.e., that which uses progressive overload, variation, and specificity, is essential to maximize the benefits associated with resistance training.

Book Reviews

A Savage War of Peace: Algeria 1954-1962

Alistair Horne
New York Review Books: New York, 2006. ISBN: 1-59017-218-3

Review by Warner D. Farr



Historians are overly eager to point out that nothing is really new in this world and that history endlessly repeats itself. A new paperback edition of Alistair Horne's classic book from 1977 has been reprinted. The author's new preface, directly connects Iraq to Algeria: the Algerian insurgents avoided direct attacks on the French army, they attacked police and other easy vulnerable targets, the porous borders aided insurgents, local support dwindled, and there were issues of torture. This book is long (>600 pages), the print is small, and it needs to be studied, not just read, but it is well worth it.

Americans tend to compare insurgency in Iraq to the Vietnam War, but this book for many is a much better analogy. Many points in Horne's lucid, well-organized history will deepen your understanding of the Iraq War. The French in Algeria relentlessly misunderstood the nature of their opponent, the lack of support from the population, and the true local roots of the insurgency. They also showed continuous official optimism repeatedly declaring the war "virtually over" and then losing four years later.

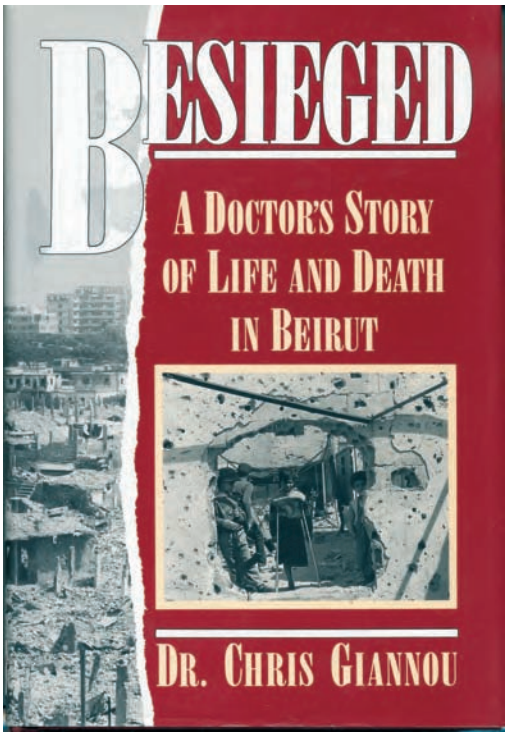
One of many insightful comments, as America rushes to stand up indigenous Iraqi forces, is that throughout the eight years of the Algerian war, more Algerians were fighting on the French side than on the rebel side — and the French still lost. The casualty figures of the Harkis, the loyal Algerians, are particularly striking, as is their exile with the French from Algeria. Sure, we are not the classic colonial power in Iraq, seeking to maintain a presence with troops and colonists. We would like to leave, but the section of the book on France's leaving – elements of the French military tried to assassinate French President Charles de Gaulle for pulling out of "a bottomless quagmire" – show those hazards.

These two wars, Algeria and Iraq, both show conventional Western militaries fighting urban insurgencies in Arab cultures with support for the war dwindling at home with insurgents striving to outlast better-armed opponents. As the quote on the book cover says, "Anyone interested in Iraq should read this book immediately." This book, written well before the Iranian Revolution and Al Qaeda, remains timely, was always a bestseller.

Besieged: A Doctor's Story of Life and Death in Beirut

Christopher Giannou
Olive Branch Press: New York, 1992

Review by COL Warner Farr



Dr. Chris Giannou is an Egyptian trained general surgeon. He was the primary surgeon and chief medical support for the Shatila Palestinian refugee camp in Beirut, Lebanon, from late 1985 until early 1988. In twenty-six months, he performed 700+ operations under primitive wartime conditions in an isolated, besieged, refugee community of 3,500 people living in a 200 by 200-yard ghetto, and under attack by a Syrian-backed Lebanese faction.

The book is quite informative about the situation of Palestinians in Lebanon during the 1980s. Giannou does an excellent job of explaining complicated politics behind the battles and writes just as well describing the primitive, unsanitary conditions in the camps. The Palestinians divided into many factions, and many fought against the PLO forces during the siege. The enemies of the Palestinians in this battle were the other Arabs, not the Israelis, and the Palestinians were not all followers of the PLO.

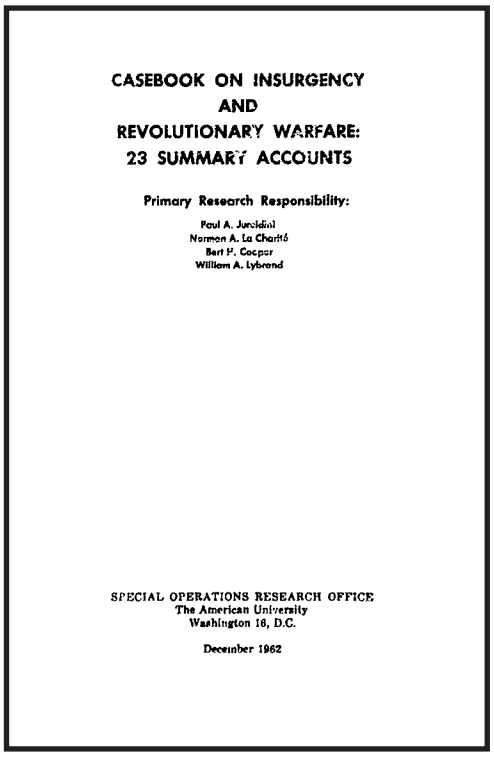
During Dr. Giannou's time in Lebanon, the camp endured a four-day battle, a 20-day battle, and 134 days of nonstop attack that accounted for 765 wounded and 110 dead residents. The book is well written and vividly tells the story of a country unraveling. Lebanon continues to have internecine and international warfare like the time he describes.

With Lebanon back in the news, it would be a good time to find this book on the used book market and read Dr. Giannou's personal account. He and I were together in South Africa last year and fought like cats and dogs. He is now the head surgeon at the International Committee of the Red Cross and a Canadian leftist. He was grand to argue with; his surgical and war medicine knowledge is superb, and I respect him greatly. I highly recommend this book to get a flavor of another world of medicine.

Casebook on Insurgency and Revolutionary Warfare: 23 Summary Accounts

P.A. Jurcidini; N.A. La Charito; B.H. Cooper; W.A. Lybrand
Special Operations Research Office. American University, December 1962.
Now available at: http://www.b13777.com or http://handle.dtic.mil/100.2/AD416553

Reviewed by Warner D. Farr, MD


CASEBOOK ON INSURGENCY
AND
REVOLUTIONARY WARFARE:
23 SUMMARY ACCOUNTS

Primary Research Responsibility:

Paul A. Jurcidini
Norman A. La Charité
Bert H. Cooper
William A. Lybrand

SPECIAL OPERATIONS RESEARCH OFFICE
The American University
Washington 16, D.C.

December 1962

To many of the historical researchers and doctrinal deep thinkers in unconventional warfare the written products of the Special Operations Research Office at the American University in Washington, D.C., during the early 1960s are an untapped gold mine. One of their larger books is now available on the web at http://handle.dtic.mil/100.2/AD416553 or go to http://www.613777.com and click on "Interesting Reads".

This is a "reader" on revolutionary warfare. It provides a general introduction to revolutionary warfare and serves as a consolidated source of background information on a number of revolutions of interest, some widely known and some relatively unknown. It uses a standard outline to summarize each to facilitate comparisons among the revolutions. This casebook provides summary descriptive accounts of 23 revolutions that have occurred in seven geographic areas of the world, mostly since World War II. Each revolution is described in terms of the environment in which it occurred, the form of the revolutionary movement itself, and the results that were accomplished.

The casebook was designed to "(1) present a comprehensive introduction to the subject of revolutions; (2) to illustrate the types of political, military, cultural, social, and economic conditions under which revolutions have occurred; and (3) to examine the general characteristics of prior revolutionary movements and some operational problems experienced in waging, or countering revolutionary warfare."

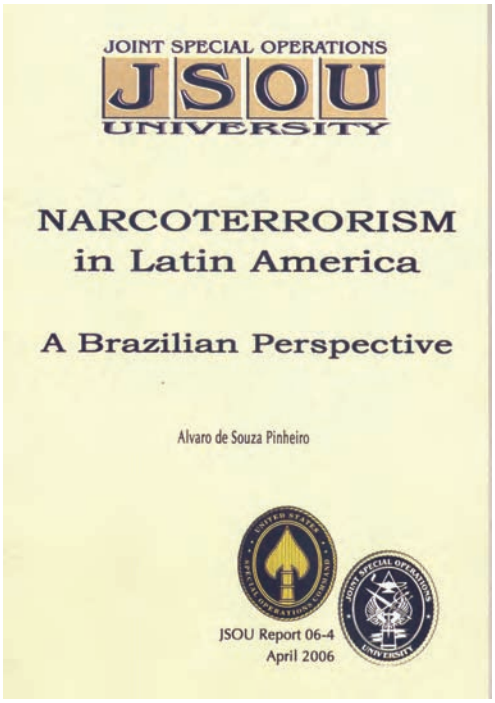
The wars, insurrections, coups, and revolutions covered are: Vietnam: 1946-1954; Indonesia 1945-1949; Malaya: 1948-1957; Guatemala: 1944; Venezuela: 1945; Argentina: 1943; Bolivia: 1952; Cuba: 1953-1959; Tunisia: 1950-1954; Algeria: 1954-1962; French Cameroun: 1956-1960; Congo: 1960; Iraq: 1936; Egypt: 1952; Iran: 1953; Iraq: 1958; Sudan: 1958; Korea: 1960; China: 1927-1949; Germany: 1932; Spain: 1936; Hungary: 1956; and Czechoslovakia: 1948. Each of the geographic areas of the world is discussed in broad terms to include: background of colonial rule, political, economic, education, ethnic minorities, development of independence, the interwar period, World War II, and a general discussion of the revolutions in the geographic area.

The work has a section on definitional terms used in the casebook and explains the format used to gain insight into the rationale for the standard outline used. All of the sources used in preparation of this book were unclassified, moreover, mostly secondary sources. It is very well referenced and has many references not seen elsewhere. The cases are presented without any particular "slant" on the revolutions covered, or the actors and parties in them. It presents as objective an account as possible of what happened in each revolution, in terms of the standard outline used. It has concise summary accounts from the viewpoint of an impartial, objective observer. One of its strengths is its definitions. Revolution is defined as "the modification, or attempted modification, of an existing political order at least partially by the unconstitutional or illegal use, or threat of use, of force. Similar definitions are given for counterrevolution, coup-d'etat, rebellion, post accessional revolution, and insurrection.

Narcoterrorism in Latin America: A Brazilian Perspective

Alvaro de Souza Pinheiro
Report 06-4. The Joint Special Operations University Press:
Hurlburt Field, Florida, 2006. 79 pages. ISBN 1-933749-13-X.

Review by Warner D. Farr



Major General (Retired) Alvaro de Souza Pinheiro of the Brazilian Special Forces brings us a timely reminder of the imminent threat of terrorism to our own western hemisphere. While we continue our counterterrorism initiatives elsewhere, we need to be reminded of the extensive unconventional warfare history in our own backyard.

South America in particular was home to a multitude of urban guerrillas which plagued its cites for decades. Che Guevara and Carlos Marighella were perhaps the most famous guerilla leaders. The Major General has personal experience in unconventional warfare and counterterrorism. He was directly engaged in fighting against internal Brazilian revolutionary movements and commanded a special operations task force to destroy the Colombian FARC front known as the Simon Bolivar Command in operations along the Traíra River, on the border between Brazil and Colombia. FARC is the Revolutionary Armed Forces of Colombia, in Spanish the Fuerzas Armadas Revolucionarias de Colombia.

America, occupied in the Middle East and the Horn of Africa, needs to give greater attention to the narcoterrorism confluence in our own hemisphere. The monograph provides a review of Colombia's security situation, historical and current, and details the author's thoughts about the United States' support of the government of Colombian President Alvaro Uribe Velez.

The situation in the tri-border area is detailed and he describes FARC linkages within that area. The FARC's initiative to create America's Revolutionary Force (Força Revolucionária da América) may suggest an increasing narcoterrorism/transnational terrorism threat for the tri-border area and elsewhere which could become a major focus for us.

The section on Brazil's strategy, force structure, and disposition is insightful. Brazil has taken many measures to reorganize and modernize its forces to adapt to the new threats in the Amazon basin and the hemisphere in general. The author describes the Calha Norte and Sistema de Vigilância da Amazônia (SIVAM) projects. Calha Norte is a long-standing project to ensure defense and development in border areas in north and west Brazil, while SIVAM is a newly installed surveillance system for protecting the Amazon from unauthorized incursions, especially by aircraft – with a strict shoot down policy. These projects show the strategic nature of current Brazilian thinking. The Major General is a strong proponent of the "the only good terrorist is a dead terrorist" approach but mediates this with the caution that you have to eliminate the right people and protect the innocent.

One of the final chapters in the book is on "Interagency tasks with international dimensions." As we in America struggle with the interagency process and how to improve it, it is interesting to read the Brazilian experience attempting to do the same.

The book concludes with the assertion that the transnational threat is morphing onto the ongoing narcoterrorism threat and must be countered by regional cooperation among the Latin American nations most capable of taking meaningful action. He points out that America should respect each unique country, with its own expertise and capacities for countering narcoterrorism. He offers North American readers insightful commentary about narcoterrorism in the Southern Hemisphere.

Urban Guerrilla Warfare

Anthony James Joes
The University Press of Kentucky: Lexington, KY, 2007. 222 pages. ISBN 0-8131-2437-9.

Review by COL Warner Farr

Insurgencies clearly remain in vogue around the planet and the global population is moving toward the cities. Hence, guerrilla conflict in urban areas, Iraq being a current example, will continue. Practitioners of a rural guerrilla warfare ethos – Mao Tse-tung, John Singleton Mosby, Von Lettow-Vorbeck, and Ernesto "Che" Guevara developed most of the "rules" for guerrillas.

The author uses eight examples of urban guerrilla conflict across the globe from 1944 to 1998: Warsaw in 1944, Budapest in 1956, Algiers in 1957, Montevideo and Sao Paulo in the 1960s, Saigon in 1968, Northern Ireland from 1970 to 1998, and Grozny from 1994 to 1996. As all are twentieth century, they are close enough together, temporally, to perhaps show some commonalities. On the other hand, they are all diverse enough geographically to not be carbon copies of each other. In addition, they should have the ability to give some insight to counterinsurgents, as they all were opposed strenuously and most failed.

The author illustrates the fundamental differences between traditional and urban guerrilla warfare, traces the diverse origins of urban conflicts, and identifies similarities and differences in the methods of the counterinsurgent forces. Leaping to today, he persuasively argues against committing U.S. troops in urban counterinsurgencies but also offers recommendations for the successful conduct of such operations if they must be undertaken. They focus around isolation of the guerrilla, intelligence, and political preemption.

I have some disagreements with his choice of cities for urban guerrilla warfare examples; I would have liked to see Jerusalem in 1948 in there. The strongest section clearly is the section on South America; he covers several urban groups with strong teaching points for today. This section is one of the best on that arena that I have ever seen.

After spending some 150 pages on the examples, his last chapter is a 13-page conclusion, of which six are a recap of lessons, city by city. His conclusions are that "all urban guerrilla efforts are vulnerable to encirclement and ultimate annihilation. Nobody has been able to develop a strategy for overcoming these structural impediments to urban guerrilla warfare, nor is it easy to foresee changes that will seriously reduce their decisive gravity." He does speak eloquently on the need for, and usual urban absence of, a viable auxiliary and underground.

Urban Guerrilla Warfare is a readable, thorough, and fascinating discussion of a form of conflict whose dangers now confront the world.

Previously Published

A Novel Pain Management Strategy for Combat Casualty Care

Russ S. Kotwal, MD, MPH; Kevin C. O'Connor, DO; Troy R. Johnson, MD; Dan S. Mosely, MD; David E. Meyer, MS, PT; John B. Holcomb, MD

Republished with permission from The American College of Emergency Physicians. Originally published in the *Annals Of Emergency Medicine, 44(2): 121-130 © 2004.*
See editorial, p. 75

Abstract

Study objective: Pain control in trauma patients should be an integral part of the continuum of care, beginning at the scene with out-of-hospital trauma management, sustained through the evacuation process, and optimized during hospitalization. This study evaluates the effectiveness of a novel application of a pain control medication, currently indicated for the management of chronic and breakthrough cancer pain, in the reduction of acute pain for wounded Special Operations Soldiers in an austere combat environment. **Methods:** Doses (1,600 mg) of oral transmucosal fentanyl citrate were administered by medical personnel during missions executed in support of Operation Iraqi Freedom from March 3, 2003, to May 3, 2003. Hemodynamically stable casualties presenting with isolated, uncomplicated orthopedic injuries or extremity wounds who would not have otherwise required an intravenous catheter were eligible for treatment and evaluation. Pretreatment, 15 minutes posttreatment, and 5 hours posttreatment pain intensities were quantified by the verbal 0-to-10 numeric rating scale. **Results:** A total of 22 patients, aged 21 to 37 years, met the study criterion. The mean difference in verbal pain scores (5.77; 95% confidence interval [CI] 5.18 to 6.37) was found to be statistically significant between the mean pain rating at 0 minutes and the rating at 15 minutes. However, the mean difference (0.39; 95% CI –0.18 to 0.96) was not statistically significant between 15 minutes and 5 hours, indicating the sustained action of the intervention without the need for redosing. One patient experienced an episode of hypoventilation that resolved readily with administration of naloxone. Other documented adverse effects were minor and included pruritus (22.7%), nausea (13.6%), emesis (9.1%), and lightheadedness (9.1%). **Conclusion:** Oral transmucosal fentanyl citrate can provide an alternative means of delivering effective, rapid-onset, and noninvasive pain management in and out-of hospital, combat, or austere environment.

Editor's Capsule Summary

What is already known on this topic
There are fewer options for relief of pain in the battlefield setting than in routine medical care.

What question this study addressed
This study examined the use of self-administered oral transmucosal fentanyl citrate among 22 U.S. casualties of the invasion of Iraq.

What this study adds to our knowledge
Oral transmucosal fentanyl citrate was easy to administer and provided rapid analgesia, and adverse effects were few.

How this might change clinical practice
Although very preliminary, this evidence suggests that oral transmucosal fentanyl may be a useful analgesic treatment in the battlefield environment.

Introduction

Pain is the most common symptom for which people seek medical attention.[1] Optimal management of severe pain in a traditional hospital setting can in itself be a challenging process.[1-4] Attempting to manage pain in and

out-of hospital, combat, or austere environment can be even more demanding.[5-9]

Opiates have long been the mainstay of treatment for moderate to severe pain.[2,3,9,10] In the form of pills, capsules, or tablets, opiates can typically require 20 to 30 minutes to initiate pain relief. Liquids are limited by a notable first-pass metabolism and by packaging and administration restrictions imposed by a field environment. Transdermal patches can be suboptimal because of their delay in pain relief. Intramuscular or subcutaneous opiates can be inadequate because of uncertainty of absorption. Given these limitations, intravenous morphine is recommended for casualties requiring analgesia in combat.[6,7,9] Intravenous morphine can provide rapid onset of analgesia and effective titration of dosage. However, insertion of a simple intravenous catheter can often be delayed by tactical requirements and environmental limitations.[6,7,11]

Soldiers conducting airborne and ground missions in Afghanistan were injured in harsh and hostile environments, often during darkness. Injuries and pain were aggravated during delays in evacuation, followed by prolonged aerial evacuation through enemy airspace in darkened aircraft operating at low altitude, with frequent evasive aerial maneuvers. These combat experiences prompted consideration of alternatives to traditional modalities of pain management for missions in Iraq. Oral transmucosal fentanyl citrate is one alternative that was evaluated. This study describes the use of oral transmucosal fentanyl citrate in combat, characterizes the medication's effect, and reports adverse effects that were encountered.

Methods

Theoretical Model of the Problem

Before the current conflict in Iraq, several Special Operations physicians had already instituted the protocol of providing each Soldier with a ''wound pack'' of oral medications containing acetaminophen, rofecoxib, and a fluoroquinolone. Soldiers were instructed to take these medications if wounded to decrease the pain associated with injuries and to reduce the risk of wound infection.[12] With this protocol in place, some patients self-treated with first-line pain medications before evaluation by a medical provider. If a patient was still experiencing pain on presentation to a medical provider, additional pain management needs had to be met, and Soldiers were historically given intravenous morphine.

Optimally, however, the analgesic agent would be provided orally, possess a good safety profile with minimal adverse effects, be rapid in onset, and be self administrable, all characteristics of oral transmucosal fentanyl citrate. Oral transmucosal fentanyl citrate administered over a 15-minute period reaches maximal serum levels after 10 to 20 minutes. The mechanism of action of oral transmucosal fentanyl citrate is transmucosal and gastrointestinal. Oral transmucosal fentanyl citrate is rapidly absorbed through the oral mucosa and has a 5 to 10-minute onset of action. However, only 25% of the total dose is absorbed through the oral mucosa. The remaining medication is swallowed and absorbed through the intestinal mucosa. There is a significant first-pass metabolism, with only one third of the swallowed dose reaching the systemic circulation (25% of the total), which gives a total functional absorbed dose of 50% of the administered preparation.

Study Design, Setting, and Data Collection and Processing

This study documents results from a clinical practice guideline instituted during Operation Iraqi Freedom. Criteria were established to use, observe, and monitor the effectiveness of oral transmucosal fentanyl citrate in Special Operations Soldiers in a combat environment from March 3, 2003, to May 3, 2003. Oral transmucosal fentanyl citrate in 1,600mg doses was included in the aid bags of medical officers and senior paramedics conducting initial entry missions, follow-on missions, and combat casualty evacuation operations during Operation Iraqi Freedom. Because oral transmucosal fentanyl citrate is a schedule II narcotic, precautions similar to those for intravenous morphine were instituted to account for each dose and to minimize the potential for abuse.

Hemodynamically stable Soldiers presenting with isolated, uncomplicated orthopedic injuries or extremity wounds that would not have otherwise required an intravenous catheter were immediately asked to verbally rate their pain intensity on a 0 to 10 numeric rating scale,[2,5] with 0 representing no pain and 10 representing the worst possible pain. Soldiers reporting a pain score greater than 5 were provided one 1,600mg dose of oral transmucosal fentanyl citrate over a 15-minute period and asked to rate their pain at the 15-minute mark and again at 5 hours. The numeric rating scale was used because of its discriminatory power and reliability in trauma patients,[13] as well as its relative ease of use for pain intensity assessment in a dark, hostile environment.

Patients were afforded the opportunity to self-administer the medication, as well as to discontinue the medication once adequate pain control was reached or if undesirable adverse effects occurred. All patients were evaluated and monitored by medical personnel before, during, and continually after administration of the medication, which included frequent monitoring of vital signs

and pulse oximetry testing, in addition to direct observation by medical personnel. Data were collected and compiled by the authors, who were the treating providers, after the completion of each mission. Data included pain ratings, vital signs, adverse effects, and patient demographics. Every attempt to collect all data points was made. Individuals with missing data points were included and assimilated appropriately, with no data entered for missing data points.

Initial approval for the conduct of this clinical practice guideline was obtained from the task force surgeon after detailed open-forum discussions among medical and nonmedical personnel. Patient education was provided, and verbal consent was obtained from each patient before administration of the medication, as the tactical scenario permitted. After redeploying to the United States, the authors received approval to conduct a retrospective review of medical documentation from the institutional review boards at the University of Texas Medical Branch, Galveston, TX, and the Uniformed Services University of the Health Sciences, Bethesda, MD. Patient identifiers and protected health information remained secure, and the information was adequately destroyed at the earliest opportunity, consistent with the conduct of the study. Statistical analysis was accomplished using medians, means, SDs, and confidence intervals (CIs).

Results

Sixty-nine injured Soldiers were evaluated during the study, with 42 injuries sustained during airborne assaults and the remainder from ground assaults. A total of 22 male patients, mean age 26 years (range 21 to 37 years), met the conditions of the study (Table). There were no violations of the guideline criteria. Of these 22 patients, none had self-medicated with the oral wound pack, 21 received only one 1,600mg oral transmucosal fentanyl citrate dose, one received two 1,600mg oral transmucosal fentanyl citrate doses, and three required the addition of intravenous medication for pain relief.

The effect of oral transmucosal fentanyl citrate on subjective pain was notable (Figure). The mean difference in verbal pain scores (5.77; 95% CI 5.18 to 6.37) was statistically significant between the mean pain rating at 0 minutes and the rating at 15 minutes. However, the mean difference (0.39; 95% CI _0.18 to 0.96) was not statistically significant between 15 minutes and five hours, indicating the sustained action of the intervention without the need for redosing. Because of the asymmetric distribution of values, nonparametric testing through the Wilcoxon signed rank test was also conducted for pairwise comparison of medians, producing similar results.

Complete data retrieval was obtained at baseline and at 15 minutes for all 22 patients. Four patients had incomplete data at five hours. The initial pain relief experienced continued without the need for additional analgesic medications for 19 of 22 patients. Of the three patients who required further pain relief, one received a second dose of oral transmucosal fentanyl citrate and intravenous morphine and phenergan, one received intravenous morphine and phenergan, and one received intravenous morphine and valium.

Adverse effects were documented in nine patients. Transient hypoventilation, the one major adverse effect, occurred at the four-hour mark in the patient who required two oral transmucosal fentanyl citrate doses and intravenous medication for pain relief. This adverse effect occurred only after additional intravenous narcotics were provided. The adverse effect was rapidly identified and reversed readily with low-dose naloxone. There was no long-term morbidity associated with this event. Other adverse effects were minor and occurred within five to hirty minutes of medication administration, depending on the individual. These adverse effects consisted of pruritus (22.7%), nausea (13.6%), emesis (9.1%), and lightheadedness (9.1%). The one patient who experienced nausea, emesis, and lightheadedness discontinued the medication before completion.

Discussion

Fentanyl citrate is a highly lipophilic synthetic phenylpiperidine derivative that is approximately 100 times more potent than morphine and selectively binds to the m-1 and m-2 receptors. Fentanyl has been used parenterally since the early 1960s. An oral transmucosal formulation was initially approved in 1993 by the U.S. Food and Drug Administration (FDA) for use as Oralet, which was later voluntarily withdrawn from the market. In 1998, an almost identical preparation, Actiq, was also approved by the FDA. Actiq is manufactured by Cephalon (West Chester, PA) using a new compressed powder formulation incorporated into a sweetened raspberry-flavored white lozenge on a stick, which was approved by the FDA in 2003.

Absorption through the oral mucosa is responsible for oral transmucosal fentanyl citrate's rapid onset, whereas the swallowed preparation accounts for the duration effect. The terminal half-life is six to seven hours, and serum concentration increases dose dependently. Fentanyl provides effects ranging from analgesia at blood levels of 1 to 2ng/mL to surgical anesthesia and profound respiratory depression at levels of 10 to 20ng/mL. The maximum concentration of 1,600mg oral transmucosal

Table

Distribution of injuries.

Casualty No.	Mechanism	Injury	Subjective Pain 0 Min	15 Min	5 h	Other Medications	Adverse Effects
1	Airborne assault	Acute upper back strain	6	1	Missing	—	Nasal pruritus
2	Airborne assault	Grade III ankle sprain	6	0	Missing	—	Nasal pruritus
3	Airborne assault	Patellar contusion	6	0	Missing	—	Nausea, emesis, lightheadedness
4	Airborne assault	Midfoot ligament strain	7	0	0	—	—
5	Airborne assault	Tibia/fibula fracture and dislocation	9	0	0	—	—
6	Airborne assault	Medial malleolar fracture	7	0	0	—	—
7	Airborne assault	Grade III medial collateral ligament sprain	7	0	0	—	—
8	Airborne assault	Left ankle fracture/right ankle sprain	7	0	0	—	—
9	Airborne assault	Transient compartment syndrome	6	0	0	—	—
10	Airborne assault	Ankle fracture	6	1	1	—	—
11	Airborne assault	Acute lower back pain	7	2	2	—	—
12	Airborne assault	2 to 4 Metatarsal fractures	7	1	1	—	—
13	Airborne assault	Tibia/fibula fracture and dislocation	10	4	1	IV morphine, IV phenergan	Nausea, lightheadedness
14	Airborne assault	Knee dislocation and dislocation total disruption	10	5	Missing	Second dose of OTFC, IV morphine, IV phenergan	Hypoventilation
15	Airborne assault	Foot fracture	6	1	1	—	—
16	Airborne assault	Foot injury	6	0	0	—	—
17	Airborne assault	Ankle fracture	6	1	1	—	—
18	Airborne assault	Ankle fracture	8	4	4	—	Pruritus
19	Airborne assault	Tibia/fibula fracture	8	4	4	—	Pruritus
20	Airborne assault	2 to 5 Metatarsal fractures	7	3	3	—	Pruritus
21	Ground assault	Knee contusion and sprain	8	0	0	—	Nausea, emesis
22	Ground assault	Acute low back pain	8	4	0	IV morphine, IV valium	—

IV, Intravenous; OTFC, oral transmucosal fentanyl citrate.

fentanyl citrate was 2.51ng/mL in clinical efficacy trials.[14] However, it is important to note that fentanyl is capable of producing respiratory depression at recommended dosages in opiate-intolerant individuals. Oral transmucosal fentanyl citrate undergoes metabolism in the liver and intestinalmucosa by the cytochrome P450 3A4 isozyme to an inactive metabolite, norfentanyl.

Numerous studies have been conducted on adults and children using oral transmucosal fentanyl citrate for procedural pain control and pain control in the preoperative and postoperative period.[15-28] Studies have also been conducted to support the current FDA-approved indication for Actiq, which is for opiate-dependent breakthrough pain in cancer patients.[29-33] All of these studies report on the ability of oral transmucosal fentanyl citrate to effectively provide opiate analgesia with minor adverse effects. In 1991, Lind et al.[34] published a report on the use of oral fentanyl citrate for severe pain in emergency departments (EDs). Although oral transmucosal fentanyl citrate was recommended for wilderness medical support by Weiss[8] in 1999, we have found no other studies conducted with oral transmucosal fentanyl citrate in the out-of-hospital setting.

In this study, oral transmucosal fentanyl citrate appeared to bridge the gap in pain control for a specific subset of casualty patients who would have otherwise received intravenous opiate analgesia, which allowed medical providers to focus their attention on the most severely injured patients while providing adequate pain control to less severely injured pa-

tients. The current practice for Special Operations forces in the treatment of hemodynamically stable patients is to forgo intravenous fluids.[6,7,35,36] The described noninvasive method of oral transmucosal fentanyl citrate pain control fits well with this practice. Front-line medical personnel carry intravenous fluids, medications, and adjunct materials limited in selection and quantity by their aid bags and the mission template. Thus, intravenous resources in combat are best reserved for hemodynamically unstable patients who require intravenous resuscitation to sustain life.

In our experience, the lozenge-on-a-stick design facilitated patient self-administration, served as a visual indicator that medication was being administered, permitted quick retrieval of the lozenge once adequate pain relief was obtained, and reduced the potential for choking. Taping the stick to the patient's index finger can reduce the risk of inadvertent overmedication, because the patient must remain alert enough to actively self administer the medication. Accidental swallowing of the preparation was an initial concern that we thought was mitigated by the preparation's design and inherent pharmacodynamic properties. The significant first-pass metabolism lowers the serum concentration to 25% to 33% of the total swallowed dose. This effect, as well as a delayed serum peak concentration in swallowed preparations, was observed in one recent study.[28]

Patients receiving oral transmucosal fentanyl citrate in this study removed and inserted the lozenge as desired. Thus, they were able to stop medication administration when adequate analgesia was achieved or in response to adverse effects. Although an optimal principle of desired pain control, self-titration could account for the lower adverse-effect profile observed in this study. Although viewed by the authors as an advantage of this medication, this type of administration may have limited our ability to observe the actual safety of the 1,600mg dose. Additionally, provider control of titration for a measurable baseline minimum effective dose required for individual pain thresholds for specific injuries may necessitate a guideline that institutes multiple smaller doses through time.

In this study, minor adverse effects were seen in 36% of patients and were limited to pruritus, nausea, emesis, and lightheadedness. It should be noted that fatigue, emotion, heat, and map-of-the-earth tactical flight can autonomously invoke nausea and emesis, and most certainly these factors can synergistically prompt or exacerbate existing medication adverse effects. Most studies cite the frequency of pruritus at 50% to 60% (range 3% to 81%), vomiting at 40% (range 0% to 65%), and transient oxygen desaturation below 94% as rare (range 0% to 24%).[21] Major adverse effects can include respiratory depression, chest wall rigidity, and bradycardia. In this study, respiratory depression was observed in one patient, and no episodes of chest wall rigidity or nonphysiologic bradycardia were reported.

The injuries in this study resulted from blunt trauma and included strains, sprains, dislocations, and fractures. There were no individuals in the study population with penetrating trauma because many of these casualties required intravenous resuscitation and

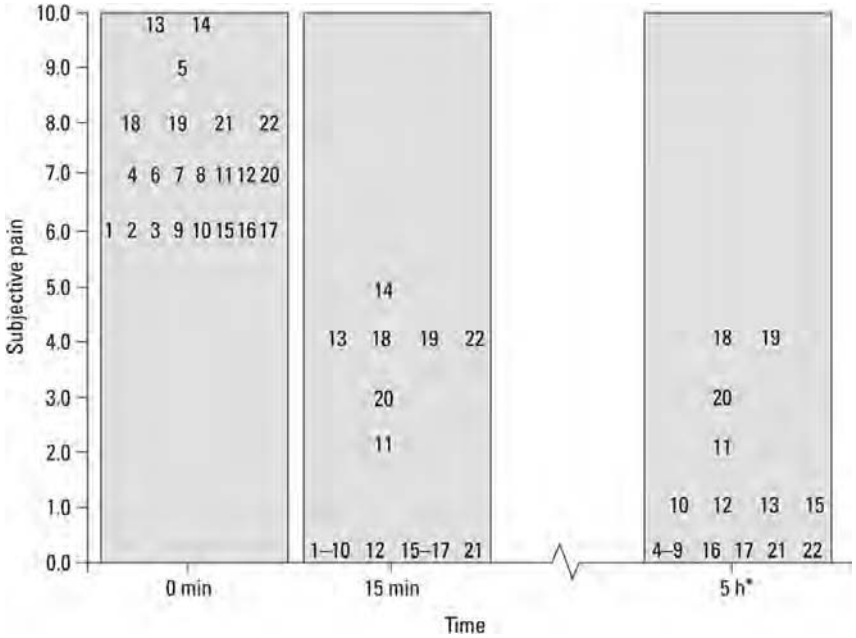


Figure
Casualty number plot of effect of 1,600mg dose of oral transmucosal fentanyl citrate on subjective pain. The median pain rating at initial presentation was 7.0 (mean 7.18, SD 1.26, 95% CI 6.62–7.74, N=22). The median pain rating at 15 minutes after medication administration was 1.0 (mean 1.41, SD 1.74, 95% CI 0.64–2.18, N=22), and the median pain rating at 5 hours after medication administration was 0.5 (mean 1.00, SD 1.37, 95% CI 0.32–1.68, N=18). Eight casualties (1, 2, 3, 13, 18, 19, 20, 21) experienced minor adverse effects, and 1 casualty (14) experienced a major adverse effect. *Data were not obtained for 4 casualties (1, 2, 3, 14) at the 5-hour mark. Three casualties (13, 14, 22) received additional pain medication before this time.

medication. Similarly, individuals with closed head injuries and severe spinal injuries with neurologic deficits were not included.

In 2002, the Centers for Disease Control and Prevention reported 4.3 million nonfatal sports and recreation-related injuries treated in U.S. EDs.[37] Of those, 1.2 million (29.1%) injuries were sprains and strains, 881,000 (20.5%) injuries were fractures, and the most common body part to sustain injury was the ankle (516,000 [12.1%] injuries). Although only military injuries were evaluated in this study, similarities can be seen between the Centers for Disease Control and Prevention injury data and injury data depicted in this study.

Thus, the need for out-of-hospital pain management is definitely not limited to the military. Millions of people worldwide experience injuries every year that require out of-hospital care and transport to EDs. However, according to Dachs,[38] recent studies note that out-of-hospital care providers continue to harbor non-evidence-based assumptions that lead to ineffective treatment of patients with severe pain. As observed in this study, medical personnel can target and rapidly administer analgesia in close proximity to the point of wounding to provide definitive pain control.

Oral transmucosal fentanyl citrate lozenges appear to be an acceptable pain management alternative for administering rapid-onset opiate analgesia in the out-of-hospital combat setting, and we recommend the continued use and exploration of an oral transmucosal fentanyl citrate clinical practice guideline for combat applications. Future application should include additional titration through multiple lower doses given sequentially as needed to delineate individual requirements for specific injuries, possibly reduce adverse effects, and further increase the margin for safety. Additionally, oral transmucosal fentanyl citrate should be considered for treatment of noncombat injuries that result from field-training exercises, parachuting, and other potentially hazardous military and paramilitary activities. Select out-of-hospital trauma resulting from falls, motor vehicle crashes, sporting events, and other causes could also potentially benefit from the use of oral transmucosal fentanyl citrate.

We would like to recognize Clarence Jernigan, MD, MPH, and Steven Swann, MD, for their guidance on this project, and Raymond Sterling, PA-C, MPAS, and Robert B. Wenzel, MD, for their clinical contributions. We would also like to recognize all of the Special Operations medical personnel who, in conjunction with the Combat Paramedics of the 75th Ranger Regiment, provided support to the injured Soldiers involved in this study.

Author contributions: RSK and KCO initially proposed and used oral transmucosal fentanyl citrate in combat. RSK, KCO, TRJ, and DSM conceived the study. RSK, KCO, TRJ, DSM, and DEM were involved in data collection. TRJ and DSM conducted the initial literature review. RSK, TRJ, and DSM drafted the initial manuscript. RSK performed the statistical analysis, and all authors contributed substantially to manuscript revision and critical review. RSK takes responsibility for the paper as a whole. Received for publication January 28, 2004. Revision received March 1, 2004. Accepted for publication March 18, 2004. The views, opinions, and findings contained in this report are those of the authors and should not be construed as official Department of the Army position, policy, or decision, unless so designated by other official documentation. Citations of commercial organizations and trade names in this report do not constitute an official Department of the Army endorsement or approval of the products or services of these organizations.

The authors report this study did not receive any outside funding or support.

References

1. American Pain Society. Pain assessment and treatment in the managed care environment: A position statement from the American Pain Society. *Case Manager*. 2000;11:50-53.
2. Acute Pain Management Guideline Panel. Acute Pain Management: Operative or Medical Procedures and Trauma: Clinical Practice Guideline. Rockville, MD: Agency for Health Care Policy and Research, U.S. Department of Health and Human Services; 1992. AHCPR publication 92-0032.
3. Ducharme J. (2000). Acute pain and pain control: State of the art. *Ann Emerg Med*.;35: 592-603.
4. Wilson JE, Pendleton JM. (1989). Oligoanalgesia in the emergency department. *Am J Emerg Med*;7:620-623.
5. National Association of EMS Physicians. Prehospital pain management: A position paper from the National Association of EMS Physicians. *Prehospital Emerg Care*. 2003; 7:482-488.
6. Butler FK Jr, Hagmann J, Butler EG. (1996). Tactical combat casualty care in Special Operations. *Mil Med*;161(Suppl):3-16.
7. Butler FK Jr, Hagmann JH, Richards DT. (2000). Tactical management of urban warfare casualties in Special Operations. *Mil Med*;165(4 Suppl):1-48.
8. Weiss E. (1999). Medical considerations for wilderness and adventure travelers. *Med Clin North Am*;83:885-902.
9. Bowen T. (1988). Emergency War Surgery: Second United States Revision of the Emergency War Surgery NATO Handbook. Washington, DC: U.S. Government Printing Office.
10. Leawood KS. (2003). Managing Pain: Dispelling Myths. Leawood, KS: American Academy of Family Practice Physicians.
11. Shwartz RB, Charity BM. (2001). Use of night vision goggles and low-level light source in obtaining intravenous access in tactical conditions of darkness. *Mil Med*;166: 982-983.
12. O'Connor KC, Butler FK. (2003). Antibiotics in tactical combat casualty care. *Mil Med*; 168:911-914.
13. Berthier F, Potel G, Leconte P, et al. (1998). Comparative study of methods of measuring acute pain intensity in an ED. *Am J Emerg Med*;16:132-136.

14. NDA 20–747. Clinical Pharmacology and Biopharmaceutics Review of Actiq (Oral Transmucosal Fentanyl Citrate). Rockville, MD: US Food and Drug Administration Center for Drug Evaluation and Research; 1997.
15. Ashburn MA, Lind GH, Gillie MH, et al. (1993). Oral transmucosal fentanyl citrate (OTFC) for the treatment of postoperative pain. *Anesth Analg*;76:377-381.
16. Ashburn MA, Streisand JB, Tarver SD, et al. (1990). Oral transmucosal fentanyl citrate for premedication in paediatric outpatients. *Can J Anaesth*;37:857-866.
17. Feld LH, Champeau MW, van Steennis CA, et al. (1989). Preanesthetic medication in children: a comparison of oral transmucosal fentanyl citrate versus placebo. *Anesthesiology*;71:374-377.
18. Gerwels JW, Bezzant JL, Le Maire L, et al. (1994). Oral transmucosal fentanyl citrate premedication in patients undergoing outpatient dermatologic procedures. *J Dermatol Surg Oncol*; 20:823-826.
19. Klein EJ, Diekema DS, Paris CA, et al. (2002). A randomized, clinical trial of oral midazolam plus placebo versus oral midazolam plus oral transmucosal fentanyl for sedation during laceration repair. *Pediatrics*;109:894-897.
20. Macaluso AD, Connelly AM, Hayes WB, et al. (1996). Oral transmucosal fentanyl citrate for premedication in adults. *Anesth Analg*;82:158-161.
21. Proudfoot J. (1995). Analgesia, anesthesia, and conscious sedation. *Emerg Med Clin NorthAm*;13:357-379.
22. Sacchetti A, Schafermeyer R, Geradi M, et al. (1994). Pediatric analgesia and sedation. *Ann Emerg Med*;23:237-250.
23. Schechter NL, Weisman SJ, Rosenblum M, et al. (1995). The use of oral transmucosal fentanyl citrate for painful procedures in children. *Pediatrics*;95:335-339.
24. Schutzman SA, Burg J, Liebelt E, et al. (1994). Oral transmucosal fentanyl citrate for premedication of children undergoing laceration repair. *Ann Emerg Med*;24:1059-1064.
25. Schutzman SA, Liebelt E, Wisk M, et al. (1996). Comparison of oral transmucosal fentanyl citrate and intramuscular meperidine, promethazine, and chlorpromazine for conscious sedation of children undergoing laceration repair. *Ann Emerg Med*;28:385-390.
26. Stanley TH, Hague B, Mock DL, et al. (1989). Oral transmucosal fentanyl citrate (lollipop) premedication in human volunteers. *Anesth Analg*;69:21-27.
27. Streisand JB, Stanley TH, Hague B, et al. 1989). Oral transmucosal fentanyl citrate premedication in children. *Anesth Analg*;69:28-34.
28. Wheeler M, Birmingham PK, Dsida RM, et al. (2002). Uptake pharmacokinetics of the Fentanyl Oralet in children scheduled for central venous access removal: Implications for the timing of initiating painful procedures. *Paediatr Anaesth*;12:594-599.
29. Carver AC, Foley KM. (2001). Symptom assessment and management. *Neurol Clin*;19: 921-947.
30. Coluzzi PH, Schwartzberg L, Conroy JD, et al. (2001). Breakthrough cancer pain: A randomized trial comparing oral transmucosal fentanyl citrate (OTFC) and morphine sulfate immediate release (MSIR). *Pain*;91:123-130.
31. Fine PG, Marcus M, De Boer AJ, et al. (1991). An open label study of oral transmucosal fentanyl citrate (OTFC) for the treatment of breakthrough cancer pain. *Pain*;45:149-153.
32. Li JM. (2002). Pain management in the hospitalized patient. *Med Clin North Am*;86:771-795.
33. O'Mahony S, Coyle N, Payne R. (2000). Multidisciplinary care of the terminally ill patient. *Surg Clin North Am*;80:729-745, xi.
34. Lind GH, Marcus MA, Mears SL, et al.(1991). Oral transmucosal fentanyl citrate for analgesia and sedation in the emergency department. *Ann Emerg Med*;20:1117-1120.
35. Owens TM, Watson WC, Prough DS, et al. (1995). Limiting initial resuscitation of uncontrolled hemorrhage reduces internal bleeding and subsequent volume requirements. *J Trauma*;39:200-207.
36. Holcomb JB. (2003). Fluid resuscitation in modern combat casualty care: Lessons learned from Somalia. *J Trauma*;54(5 Suppl):S46-51.
37. Gotsch K, Gilchrist J. (2002). Nonfatal sports- and recreation-related injuries treated in emergency departments: United States, July 2000-June 2001. MMWR *Morb Mortal Wkly Rep*;51:736-737.
38. Dachs R. (2001). Eleven common myths about pain control. *Emerg Med*;33:19-25.

Emergency Medicine Research on the Front Lines

LTC Robert A. De Lorenzo, MD, MC, USA
From the Department of Emergency Medicine, Brooke Army Medical Center, Fort Sam Houston, TX.

Republished with permission from The American College of Emergency Physicians. Originally published in the *Annals Of Emergency Medicine, 44(2): 121-130 © 2004.*

See related article, p. 68 *[Ann Emerg Med. 2004;44:128-130.]*

Sometimes it is not the results themselves that distinguish a research study. A study's unique setting, special population, or novel methodology can also set it apart. So it is with the study by Kotwal et. al.[1] in this issue of Annals. In this study, oral transmucosal fentanyl citrate was used as primary analgesia for wounded or injured Soldiers. Hemodynamically stable subjects with isolated extremity trauma were given oral transmucosal fentanyl in 1,600mg doses and asked to rate their pain on a verbal numeric rating scale of 1 to 10. Twenty-two patients met inclusion criteria, and not surprisingly, all appeared to obtain clinically and statistically significant pain relief lasting for 5 hours. Side effects were minimal, although the authors carefully noted that limited study power precludes claims of safety.

Oral transmucosal fentanyl is approved by the U.S. Food and Drug Association for the treatment of acute pain, and as the authors point out, it has already been studied in the emergency department. Therefore, it is neither the drug nor its use in emergency care that strikes a chord. Even the casual observer will note the study weaknesses: a small number of subjects, lack of control subjects, and verbal assessments of pain. What sets this study apart is the environment in which it was conducted: a theater of war. The authors successfully executed an interventional study in the harsh and unforgiving environment of combat.

Few acute care studies are conducted in combat settings. What modern science does exist is derived largely from Vietnam-era epidemiologic and pathologic data, supplemented by observations compiled in Operation Desert Storm (the first Gulf War) and other more recent conflicts.[2-5] Combined with traditional civilian trauma and resuscitation research, this forms the basis of modern casualty care practice. This study, however, raises the bar by conducting interventional research not in an urban hospital or relatively calm rear echelon medical unit, but rather in a forward-deployed, austere, and hostile war zone. By way of comparison, this is the difference between a routine study in the emergency department and one, not just in the out-of-hospital setting, but in the hot zone of a law enforcement tactical (e.g., Special Weapons and Tactics [SWAT]) operation.

Studies like that of Kotwal et al[1] are important for two reasons. First, they serve as calls to arms, as it were, for emergency medicine research on the front lines. Since September 11, 2001, the potential for terrorism and conflict has increased and the desire for reliable evidence to guide care for victims of such violence has never been so pressing. Emergency physicians have the diversity of training, interest, and forward proximity to answer the broad range of clinical questions asked in the casualty care field. Emergency medicine researchers should take a leadership role in designing, implementing, and supporting research to save lives and reduce suffering in this now very dangerous world.

Of interest, the U.S. Department of Defense sponsors numerous studies and grants for both in-house and civilian institution-based research. The Army alone manages nearly $1 billion annually in medical research and development funding, with a portion earmarked for universities and other research institutions.[6] Some of the more active Department of Defense agencies include the Army Medical Research and Materiel Command's Medical Research Institutes of Infectious Disease, Chemical Defense, and Environmental Medicine, Walter Reed Army Institute of Research, and Institute for Surgical Research; the Navy Bureau of Medicine and Surgery's Naval Health and Medical Research Centers; the Air Force Research Laboratory's Human Effectiveness Directorate; and the Defense Advanced Research Projects Agency.[7-10]

The second point underscored by the study by Kotwal et al.[1] is more reflective: What are the ethics of combat research? The ethical calling to conduct resuscitation research and its potential pitfalls are well known and recently editorialized in this journal.[11] However, a study on military personnel in the combat zone adds a new dimension.[12] Can a wounded Soldier provide truly voluntary, informed consent? Although U.S. Department of Defense research guidelines do not specifically identify combat casualties as a vulnerable population, one

could hardly argue that a wounded and suffering young service member, thousands of miles from home, is not somehow vulnerable in this context.[13] The Department of Defense is sensitive to this possibility and has additional restrictions on studies, including a need to obtain consent in advance, and, in cases where consent cannot be obtained (e.g., pediatric and some resuscitation trials), the intervention must intend to be beneficial for the patient.[14] The special superior-subordinate relationship among military service members is also addressed in Department of Defense rules, which are intended to mitigate the possibility of undue influence by the subject's chain of command.[14] Nevertheless, Department of Defense and other federal guidelines allow for waiver of consent for emergency research and may offer a solution to ethically conducting some wartime studies.[15,16]

Several ongoing Department of Defense-supported studies use waiver of consent, and early indications suggest this ethical approach is working satisfactorily. In fact, because service members and their commanders form close-knit professional communities, it appears advance notification and education are far easier to accomplish and more successful than in general society. This trust can also help avoid the controversy of recent military vaccine programs. Several highly publicized refusals by service members to take the vaccines and complaints by some that the vaccines were ''experimental'' nearly derailed these important programs.[17] The vaccine experience illuminates the importance of gaining the trust and consent of the individual subject, the greater military community, and the public at large.

Kotwal et al.[1] appear to have overcome many ethical pitfalls by establishing a strong bond beforehand with the Soldiers and leaders in their relatively small Special Operations unit. This bond, coupled with a willingness to share risk by maintaining a presence at the ''front,'' likely gave the researchers the needed access and trust to accomplish the study. Nonetheless, in the context of a research study, this special physician-researcher and service member-subject relationship is complex and not completely understood, even by those in uniform. Further discussion may be necessary to establish practical standards and guidelines.

Even in this new global era, some readers may wonder why combat casualty research is important to them and their patients. The reasons become readily apparent when examining the parallels between combat settings and other austere or hostile environments such as tactical emergency medical support for law enforcement, wilderness and disaster medicine, and coping with the effects of weapons of mass destruction. The lessons of Vietnam and the development of trauma systems, the ''golden hour,'' and air medical services provide additional reminders of the mutual benefits gained by military and civilian practice.[5,18] In war as in peace, emergency physicians stand proudly beside our first responders, ready to provide care under fire. Emergency physician researchers are uniquely positioned in this regard, and the challenge now is to take up where Kotwal et al.[1] left off to further advance the science on the front.

The author reports this study did not receive any outside funding or support.

The opinions or assertions in this article are those of the author and do not necessarily reflect the official views of the Army Medical Department or the Department of Defense.

Reprints not available from the author.

Address for correspondence: LTC Robert A. De Lorenzo, MD, Department of Emergency Medicine, MCHE-EM, Brooke Army Medical Center, 3851 Roger Brooke Drive, Ft. Sam Houston, TX 78234- 6200; 201-916-1006; E-mail RADeLorenzo@satx.rr.com.

REFERENCES

1. Kotwal RS, O'Connor KC, Johnson TR, et al. A novel pain management strategy for combat casualty care. *Ann Emerg Med.* 2004;44:121-127.
2. Bellamy RF. The causes of death in conventional land warfare: Implications for combat casualty research. *Mil Med.* 1984; 149: 55-62.
3. Zajtchuk R, Jenkins DP, Bellamy RF, et al. (1990). Textbook of Military Medicine: Conventional Warfare—Ballistic, Blast and Burn In juries. Washington, DC: Department of the Army, Office of the Surgeon General.
4. Burkle FM Jr, Newland C, Meister SJ, et al. (1994). Emergency medicine in the Persian Gulf War—Part 3: Battlefield casualties. *Ann Emerg Med.* 1994;23:755-760.
5. Trunkey DD, Slater M. (1999). Management of battle casualties. In: Mattox KL, Feliciano DV, Moore EE, eds. Trauma. 4th ed. New York, NY: McGraw-Hill Professional.
6. Vander Hamm DG. Overview of Army Medical Research process, programs and investment strategy (U.S. Army Medical Research Acquisition Activity Web site). Available at: http://usamraa-www.army.mil/. Accessed May 22, 2004.
7. U.S. Army Medical Research and Materiel Command Web site. Available at: http://mrmc-www.army.mil/. Accessed May 22, 2004.
8. Navy Bureau of Medicine and Surgery Web site. Available at: http://navalmedicine.med.navy.mil/. Accessed May 22, 2004.
9. Air Force Research Laboratory, Wright-Patterson Air Force Base Web site. Available at: http://www.he.afrl.af.mil/. Accessed May 22, 2004.
10. Defense Advanced Research Projects Agency Web site. Available at: http://www.darpa.mil/. Accessed May 22, 2004.
11. Fish SS. Informed consent: Time for a national dialogue? *Ann Emerg Med.* 2004;43:449-451.
12. Maningas PA. (1989). Combat casualty care research and informed consent. *Mil Med*;154:71-73.
13. Title 32, CFR 219. Office of the Secretary of Defense, Protection of Human Subjects. Washington, DC: US Government Printing Office; July 1, 2000.

14. Title 10, USC 980. Armed Forces, General Military Law, Personnel, Miscellaneous Prohibitions and Penalties. Washington, DC: U.S. Government Printing Office; 2002.
15. U.S. Department of Defense. Directive No. 3216.2, Protection of human subjects and adherence to ethical standards in DoD-supported research. March 25, 2002.
16. Biros MH. (2003). Research without consent: Current status, 2003. *Ann Emerg Med*;42:550-564.
17. Schofer JM. (1999). Violations of informed consent during war. *JAMA*;281:1657.
18. De Lorenzo RA. (1997). Military and civilian emergency aeromedical services: Common goals and different approaches. *Aviat Space Environ Med*;68:56-60.

Causes of Death in U.S. Special Operations Forces in the Global War on Terrorism *2001–2004*

John B. Holcomb, MD; Neil R. McMullin, MD; Lisa Pearse, MD; Jim Caruso, MD; Charles E. Wade, PhD; Lynne Oetjen-Gerdes, MA; Howard R. Champion, FRCS; Mimi Lawnick, RN; Warner Farr, MD; Sam Rodriguez, BS; Frank K. Butler, MD

Republished with permission of Lippincott Williams Wilkins and authors. Originally published in *Annals of Surgery Volume 245 Number 6 Jun 2007. p986-991.*

Abstract

Background: Effective combat trauma management strategies depend upon an understanding of the epidemiology of death on the battlefield. **Methods:** A panel of military medical experts reviewed photographs, autopsy, and treatment records for all Special Operations Forces (SOF) who died between October 2001 and November 2004 (n = 82). Fatal wounds were classified as nonsurvivable or potentially survivable. Training and equipment available at the time of injury were taken into consideration. A structured analysis was conducted to identify equipment, training, or research requirements for improved future outcomes. **Results:** Five (6%) of 82 casualties had died in an aircraft crash, and their bodies were lost at sea; autopsies had been performed on all other 77 Soldiers. Nineteen deaths, including the deaths at sea were noncombat; all others were combat related. Deaths were caused by explosions (43%), gunshot wounds (28%), aircraft accidents (23%), and blunt trauma (6%). Seventy of 82 deaths (85%) were classified as nonsurvivable; 12 deaths (15%) were classified as potentially survivable. Of those with potentially survivable injuries, 16 causes of death were identified: 8 (50%) truncal hemorrhage, 3 (19%) compressible hemorrhage, 2 (13%) hemorrhage amenable to tourniquet, and 1 (6%) each from tension pneumothorax, airway obstruction, and sepsis. The population with nonsurvivable injuries was more severely injured than the population with potentially survivable injuries. Structured analysis identified improved methods of truncal hemorrhage control as principal research requirement. **Conclusions:** The majority of deaths on the modern battlefield are nonsurvivable. Improved methods of intravenous or intracavitary, noncompressible hemostasis combined with rapid evacuation to surgery may increase survival.

Analyzing combat mortality data determines new strategies for treatment, equipment, and training and focuses research agendas to meet contemporary goals and needs. In civilian systems of trauma care, analysis of deaths from injury has long been cornerstone of trauma system development and is essential to ongoing evaluation.[1,2] Equivalent studies have been conducted on several military data sets,[3-5] most recently from Vietnam casualties described by the Wound Data and Munitions Effectiveness Team (WEDMET) database. WEDMET has directed military medical research, logistics, and medical tactics since that time, but it is now 40 years old. Changes in body armor, improved medical care, equipment, and training since Vietnam raise the question of the applicability of the WEDMET data in the current experience. Additionally, and perhaps more importantly, 30 years of experience in maturing trauma systems research have transformed methods of death analysis.[6] The reliability of this study type has been analyzed in the past.[7] In 1992, the Preventable Death Study Group determined that a multidisciplinary group, using panel consensus rule, with autopsy reports, adequate medical records, and standardized approach, can approximate the upper bound for potentially preventable deaths.

Tactical Combat Casualty Care (TCCC) is designed to provide all Special Operations Forces (SOF) operators (medical and nonmedical) in deploying units with sufficient medical skills to sustain casualties until evacuation and if necessary, while under fire.[8,9]

TCCC training emphasizes:

- Tourniquets for extremity wounds with life-threatening bleeding to gain initial control of hemorrhage.
- Sustained direct pressure for severe external bleeding in an anatomic location where tourniquet cannot be ap plied.
- Proper casualty positioning and cricothyroidotomy instead of intubation for maxillofacial trauma associated with air way trauma. Needle decompression of tension pneumothorax.

The goal of this review was to identify which fatal injuries in the SOF between 2001 and 2004 were potentially survivable and would have been amenable to TCCC prevention and treatment modalities. The resulting data was compared with previously published data from civilian and military trauma autopsy studies. The second focus of this study was to use these findings to identify potential areas of improvement for future treatment, training, or equipment and to direct future research initiatives.

Methods

All U.S. combatants whose remains are recovered are transported to Dover, Delaware, where complete iden-

tification and forensic examination are performed by the Office of the Armed Forces Medical Examiner. This unique resource formed the basis for this report. Institutional Review Board approval for the study was provided by the U.S. Army Institute of Surgical Research and the Armed Forces Institute of Pathology.

All SOF fatalities were identified by the personnel office of the U.S Special Operations Command. These included both noncombat and combat fatalities, including those killed in action (i.e., died prior to arrival at a facility with surgical capability), as well as those who died of wounds (i.e., died after arrival at a facility with surgical capability).[10] Treatment records and files from the Joint Theater Trauma Registry and the Office of the Armed Forces Medical Examiner were compiled. Unique identifiers were removed for this review. All autopsies had been coded independent of this study for Abbreviated Injury Score (AIS) and Injury Severity Score (ISS), the standard injury scoring systems used in trauma.[7-11] The intent of this study was to identify the upper bound of potentially survivable injuries and to err on the side of inclusion. By narrowly defining too many injuries as nonsurvivable, opportunities for improvement in the delivery of medical care would have been missed.

A panel of forensic pathologists, military and civilian trauma surgeons, trauma nurse, and SOF combat medic was convened for this study. Prior to the initiation of the study, panel consensus rule format[12] was selected to determine whether, based on TCCC standards, an injury could be classified as potentially survivable or was nonsurvivable. All panel members were thoroughly familiarized with the standardized format prior to the initiation of the study. In the initial review, all cases were examined for mechanism of injury, ISS, age, medical examiner reports, and care received at the point of wounding. Unfortunately, the documentation of the in-hospital care, at any level, was frequently very limited. At the time of this review, there were no CT scans or plain x-rays available from the deployed setting. While CT autopsy has been described and is a very useful modality, these data were not available for this study. These findings determined which cases merited further in-depth review. Cases that required DNA identification or whose cause of death was "total body disruption" were recorded as nonsurvivable injuries and were not reviewed further.

In-depth review of the selected cases was conducted in a format similar to a morbidity and mortality conference. After action reviews, medical examiner's cause of death, detailed autopsy results, including toxicology, AIS and ISS scores, photos, and X-rays, were used to determine which cases sustained potentially survivable injuries. In the analysis, patients were assumed to be within the domain of the deployed U.S. level III medical treatment facilities in theater. These level III facilities are the highest standard of medical care available in the deployed setting with advanced surgical abilities, blood bank service, radiology, and laboratory support. These facilities do not have cardiopulmonary bypass capabilities and neurosurgical support is limited.

The classic terminology encountered in the civilian literature when conducting a similar analysis is "preventable death," "potentially preventable death," and "nonpreventable death." However, delivery of care on the battlefield is dictated as much by the tactical situation as by traditional medical necessity. While a casualty may sustain an injury that is considered treatable and from which the Soldier should not have died, if this same injury occurs during a fire fight that prohibits a medic or Soldier from reaching the casualty, then to categorize the death as "preventable" is erroneous. The term "preventable" implies that something could have or should have been done to alter the final outcome of the patient. Therefore, the panel decided that terminology that describes the injury sustained would better achieve the goals of this study and selected the terms "potentially survivable" and "nonsurvivable." No separate distinction of "definitely survivable" or "potentially survivable" was made. A completed questionnaire for each casualty summarized a consensus of the panel's findings and identified changes in training, treatment, or equipment that could have influenced the outcome of the casualty. These findings were then reviewed to identify possible areas for future research.

Results

Between October 2001 and November 2004, there were 82 SOF fatalities: 35 (42%) from explosions, 23 (28%) gunshot wounds, 19 (23%) aircraft crashes, 4 (5%) motor vehicle crashes, and 1 (2%) fall (Table 1). Autopsies were performed for all except 5 SOF Soldiers who died in an airplane crash and whose bodies were lost at sea. These 5 deaths were included in the count of clearly nonsurvivable injuries (n = 70). Twenty-four of the 82 cases were selected for detailed review by the panel. Eighty-five percent (n = 70) of the fatal injuries were considered nonsurvivable (ISS = 58 ± 35), while 15% (n = 12) were regarded as potentially survivable (ISS = 35 ± 9, $P < 0.05$). The 16 mechanisms of injury in these 12 deaths are shown in Table 1. Four (33%) of the potentially survivable injured were identified as died of wounds, of which 1 death occurred 56 days after injury in a medical center in the United States. The 3 other casualties all died within 24 hours of hospital admission from exsanguination: 2 from noncompressible truncal

Table 1. Mechanisms of Injury: 82 SOF Deaths Versus All Combat Injuries*

Mechanism	OIF/OEF (n = 3707) (%)	SOF (n = 82) (%)	NS (n = 70) (%)	PS (n = 12) (%)
All explosions	2030 (55)	35 (43)†	32 (46)	3 (25)
IED	1201 (32)	16 (20)	14 (21)	2 (17)
RPG	466 (12)	2(2)	1 (1)	1(8)
Rockets/mortar attack	337 (9)	1(1)	1(1)	0
Other explosions	26 (1)	16 (20)	16 (23)	0
Aircraft crash	33 (1)	19 (23)	19 (27)	0
Fall	353(9)	1(1)	0	1(8)
Gunshot wound	712 (19)	23 (28)‡	16 (23)	7(59)
MVC without IED	579 (15)	4 (5)	3(4)	1(8)
Total	3707 (100)	80 (100)	70 (100)	12 (100)

*All combat injuries from OIF and OEF, November 2004.
†0.05 for SOF versus PS, all explosions.
‡0.05 for SOF versus PS, gunshot wound.
OIF indicates Operation Iraqi Freedom; OEF, Operation Enduring Freedom; SOF, Special Operations Forces; NS, nonsurvivable; PS, potentially survivable; IED, improvised explosive device; RPG, rocket propelled grenade; MVC, motor vehicle crash.

Table 2. Abbreviated Injury Score (AIS) Distribution*

	No. Scores	PS (n = 12)	NS (n = 65)
AIS 6	40	0	40†
AIS 5	112	8	104

*n=77 as 5 deaths due to aircraft crash were not autopsied.
†P=0.001.
NS indicates nonsurvivable; PS, potentially survivable.

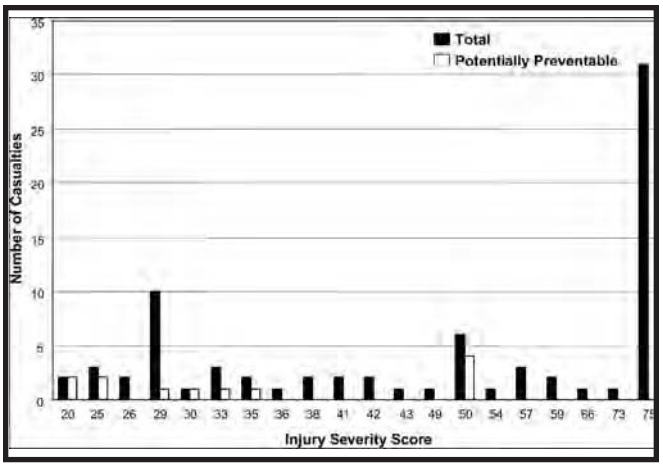


Figure 1. Injury Severity Score (ISS) ranges for Special Operations deaths in Operation Iraqi Freedom and Operation Enduring Freedom.

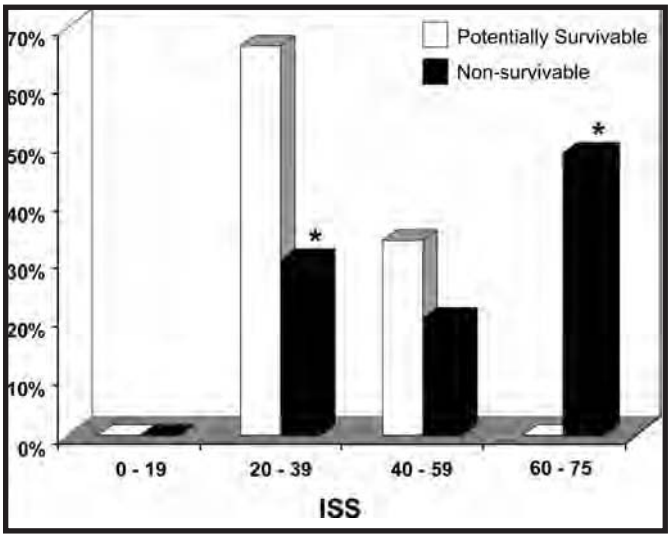


Figure 2. Injury Severity Scores (ISS) for potentially survivable casualties compared with nonsurvivable casualties.*P< 0.03 (Fisher exact test).

hemorrhage and 1 from cervical hemorrhage, potentially amenable to direct compression. The remaining (66%) potentially survivable injured were identified as killed in action and died on the battlefield.

Cause of SOF deaths differed somewhat from what has been observed in conventional military personnel throughout Operation Iraqi Freedom and Operation Enduring Freedom.[13] The SOF fatalities had a higher incidence of death secondary to gunshot wounds (28% vs. 19%; P < 0.05) and a lower incidence of death secondary to explosions (55% vs. 43%; P < 0.05; logit case control odds ratio, 95% confidence interval of 1.42–4.03).

Among nonsurvivable injuries, there were 40 AIS injuries in 31 patients (0.001) and 104 AIS injuries in 53 patients (Table 2). Among the 12 potentially survivable injuries, there were only 8 AIS 5 injuries and 18 AIS 4 injuries. The distribution of ISS is shown in Figure 1. Figure 2 shows the distribution of ISS by quartiles. Nearly one half of the nonsurvivable casualties had an ISS of 60 to 75. Using Fisher exact test, a significantly greater percentage of potentially survivable casualties were in the ISS 20 to 40 quartile (P < 0.03).

The most common potentially survivable injuries were noncompressible (truncal) hemorrhage (8), followed by hemorrhage amenable to tourniquet (3), hemorrhage not amenable to tourniquet yet compressible (2), obstructed airway (1), tension pneumothorax (1), and sepsis (1) (Figure 3). Panel members identified 4 main areas, treatment, training, equipment, or transport, which may have altered outcomes for these 12 patients (Table

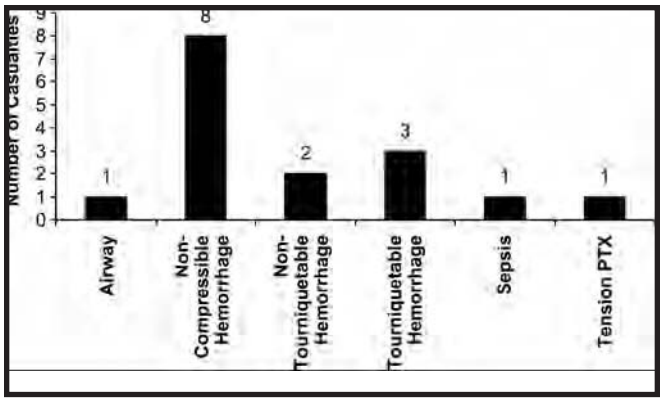


Figure 3. Sixteen potential causes of death in the 12 potentially survivable casualties.

Table 3. Areas of Possible Influence in Outcome in 12 Potentially Survivable Casualties

Potential Intervention	No. Potentially Survivable Casualties Affected
Decreased transportation times	8
Intravenous treatments	8
Uniform application of TCCC training equipment	8
	3

TCCC indicates Tactical Combat Casualty Care.

3). Some injuries fell within more than one area. Potential treatment included methods for hemostasis, including hemorrhage control with tourniquet (3) and pressure with hemostatic dressings (2). Other potential treatment included adequate airway (1) and needle thoracostomy (1). These interventions are taught to all SOF combat medics and are covered in chapter 17 on TCCC in the Pre-Hospital Trauma Life Support Manual.[14] More expeditious casualty evacuation to a facility capable of surgical intervention may have improved patient outcome in 8 casualties. In 3 casualties, improved equipment that has since become available, the Combat Application Tourniquet (1) and the HemCon hemostatic dressing (2) may have altered outcome.

Whether or not these Soldiers were wearing body armor at the time of injury was not recorded at any time prior to our evaluation. However, knowing the capabilities of armor systems and the mechanism of injury, the assumption was made that the potentially survivable injuries in casualties may have been avoided had they worn their body armor. Of the 82 SOF deaths, only 1 Soldier sustained a potentially survivable wound to the chest in an area that is not covered by body armor.

Figure 4. Chest x-ray of tension pneumothorax after fall from helicopter. This casualty also had other significant internal injuries and died 4.5 hours after injury.

Consensus was reached on 23 of the 24 (96%) reviewed cases. The one case for which no consensus was reached was a casualty who on autopsy, in addition to multiple sites of internal injury and rib fractures, was found to have a large tension pneumothorax (Figure 4). It was unclear whether the tension pneumothorax was postmortem artifact or a clinically relevant finding. Given the stated goals of this study, this death was considered by some to be a clinically relevant finding and the result of potentially survivable injuries.

Discussion

Nothing in this review is meant to detract from the accomplishments of combat medics. The small number of fatal outcomes associated with TCCC training suggests that in most cases injuries were treated appropriately by SOF combat medics. In some instances, medic may not have been present when the injuries occurred. At other times, the unit medic may have been killed or incapacitated. Critical review of deaths due to trauma is cornerstone of the evolution of trauma care systems. This type of analysis defines the direction of future research and identifies areas in need of improvement, not only in the deployed medical care system, but in the civilian medical sector as well.

Some familiarity with the trauma care system analyzed in this paper is central to understanding the limitations of this study. SOF units are often deployed in small teams and in hostile environments. Extraction of wounded combatants may be difficult and delayed, placing a significant burden on care providers at the point of

wounding. In the current study, injury, evacuation, and arrival times at a surgical facility are largely unknown. To prevent early deaths, SOF medics must be highly trained and expertly equipped and supported. This is in direct contrast to the "scoop and run" paradigm of most civilian emergency medical (EMS) systems. Civilian EMS systems in rural areas do, however, experience many of the same challenges experienced by SOF medics. These include long transportation times during which the paramedic must be able to manage obstructed airway, chest trauma, and hemorrhage.[15] The long transportation times and delay from point of injury to facility where definitive care can be provided place similar burdens on the paramedic to prevent early death. The lessons learned from this study are therefore applicable to EMS care. This is especially true for those casualties suffering truncal or noncompressible hemorrhage. Currently, there is no active intervention available to medics, who must be trained to practice hypotensive resuscitation to avoid over-resuscitation and increased hemorrhage.[14,16] In any event, this analysis was significantly limited by incomplete data from the prehospital and hospital setting. The time between wounding and casualty evacuation and the time interval between wounding and arrival at a medical treatment facility or death was known only in few of the cases. Also unknown in some cases were the specifics of care rendered on the scene and during evacuation, as well as whether or not body armor and helmets were worn by casualties.

Consistent with findings from previous conflicts,[3] 85% of the fatalities were from injuries that were not survivable. After analysis, and as evidenced by the distribution of the AIS and ISS scores (Figures 1, 2), 70 fatalities were judged to have been wounded so severely that survival would have been impossible even within the immediate reach of civilian level I trauma care. The distribution of the ISS and AIS scores supports the claims of this study that the casualties with wounds considered to be potentially survivable were not injured to the same degree as their counterparts with injuries considered to be nonsurvivable. Only 12 (15%) of the deaths were categorized as potentially survivable.

A probability of survival score was not calculated for these patients as the utilization of the ISS as predictive tool for outcomes in combat trauma has significant limitations. The ISS is obtained by summing the square value of the highest AIS scores in up to separate body regions. For example, a Soldier wounded by an improvised explosive device may have an AIS for an abdominal injury, AIS for chest injury and an AIS for an extremity injury. The ISS would then be 50, representing severe injury. The limitation here is that the ISS does not account for multiple injuries to the same body region. In our example, this same Soldier may have had more than one AIS injury or an AIS injury to his abdomen in addition to multiple AIS injuries in his chest, or bilateral AIS extremity injuries; such wounding patterns are frequently observed in casualties from improvised explosive device explosions. The conventional ISS scoring system does not account for these highly significant injuries. In our population of deaths from potentially survivable injuries, patients with AIS injuries had AIS injuries in the same body region, but these significant injuries remain unaccounted for in the calculation of the ISS for these casualties. A new military ISS system that will account for the differences between combat and civilian injuries is under development.

Comparing the percentage of potentially survivable injuries in this study with previously published reports [15,17,18] of civilian trauma care in the United States is testament to the training, skills, and battlefield successes of SOF combat medics. Those papers report 8% to 22% of prehospital deaths as preventable or potentially preventable. The 15% rate of this study falls within this range, despite more severe injuries, hostile environment, and the intent of this study to identify the upper bound of potentially survivable injuries. Taking the shortcomings of the ISS for combat casualties into consideration, the reported mean ISS of the potentially preventable deaths in one study was 25,[17] while in our population deaths from potentially survivable injuries had mean ISS of 35. The mean ISS of the 73 nonpreventable deaths from the same study was 52; ours was 56. But again, comparisons are difficult as the majority of patients reviewed in the civilian literature suffered blunt trauma from motor vehicle accidents, whereas in our study 71% of all deaths were the result of devastating penetrating trauma and only 2 potentially survivable deaths resulted from blunt trauma.

A study of 210 combat fatalities from Vietnam reported cases that were independently reviewed by 4 trauma surgeons and assessed as either "definitely preventable," "possibly preventable," "not salvageable," or "cannot determine."[4] That study was done utilizing medical records; tactical information and autopsy data were unavailable. Among 210 cases, 5.4% (range 1.0% – 11%) were noted as definitely preventable and 34.9% (range, 26.2% – 41.9%) as possibly preventable. Although the percentage of fatalities with potentially survivable wounds in our study was lower, the results are difficult to compare with this study as the methodology was different.

Three cases were identified in which the casualty had hemorrhaged from a site that was amenable to placement of tourniquet. Two of these had no tourniquet placed and one was a case of tourniquet failure. Lack of tourni-

quet use and tourniquet failure has been thoroughly investigated, followed by major initiative to field the Combat Application Tourniquet tourniquet.[19,20] This device was tested by U.S. Army Special Operations Command operators, and trauma surgeons and found to be superior in function and feasibility to the traditional "cravat and stick" used in the period of this study.

Theoretically, all of the potentially survivable injured would have benefited from more expeditious evacuation to a medical treatment facility. However, tactical environment and availability of resources, beyond the control of the healthcare provider on the ground, govern evacuation. With this in mind, this study focused on identifying the measures that can be taken to sustain a casualty until evacuation is possible. It is during this time that interventions aimed at achieving hemostasis or mitigating hemorrhage must be used.

The eight deaths from noncompressible hemorrhage demonstrate the importance of injectable hemostasis for all levels of care, but especially for medics during prehospital care. Currently, recombinant factor VIIa (rFVIIa) holds the most immediate promise, although the efficacy of this drug as sole prehospital hemostatic adjunct is unknown. Fortunately, the safety and efficacy of rFVIIa in trauma patients has been established, making the prospect of prehospital noncompressible hemostasis tantalizingly close.[21-23] Possibly, the combination of rFVIIa with other clotting factor concentrates will provide both the substrate and the thrombin burst required to accelerate clotting.[24,25] Another potential intervention, hemoglobin-based oxygen carriers (HBOC), has just recently completed phase III trials for prehospital administration. HBOC replaces the oxygen carrying capacity of shed blood allowing delivery of oxygen to vital organs during critical anemia.[26] If current trials support this indication, HBOC may be added to the SOF armamentarium to maintain oxygen delivery before evacuation. Whatever interventions are settled on, stabilization sufficient to deliver the injured to medical treatment facilities for surgical intervention will improve outcomes. "Damage control resuscitation" which incorporates the use of a pro-hemostatic adjunct, such as rFVIIa and plasma, with hypotensive resuscitation and HBOCs may allow a SOF casualty to tolerate the longer evacuation times observed in this population.[27-29]

This unique study identified areas in which medical care delivered in the field can be improved and assists in the allocation of resources for research and development. Broadly, these areas include combat casualty care training for nonmedical combatants, air evacuation and close air support resources, operational medical planning, improvements in postoperative care, and new medical interventions.

Specific findings that will enable the military to continue to improve battlefield trauma care are:

1. A total of 85% of SOF fatalities resulted from injuries that were judged to be nonsurvivable.
2. Consistent application of the currently taught TCCC guidelines might have improved outcomes for 8 of the 12 fatalities with potentially survivable injuries.
3. Damage control resuscitation represents the most promising modality at present to improve outcomes in the fatalities with noncompressible hemorrhage.
4. Inadequate anatomic coverage of the currently fielded SOF body armor was not documented in this study.

Improved methods to capture records of prehospital care rendered on the battlefield will greatly improve future efforts to perform similar studies.

These 82 deaths must be considered in the context of the over 500 SOF casualties who survived their injuries, sustained by SOF during the period encompassed by this study. That most of the SOF casualties from these conflicts survived is great credit to the courage and professionalism of the physicians, nurses, medical planners, pilots, aircrew, combat medics, and teammates who cared for our wounded warriors. Improvements in combat casualty care stem from the unfortunate repeated experience of war.[30] This analysis is a focused effort to learn lessons that will help us save casualties in battles yet to be fought.

References

1. Cales RH, Trunkey DD. Preventable trauma deaths: Review of trauma care systems development. *JAMA*. 1985;254:1059 – 1063.
2. Dubois RW, Brook RH. Preventable deaths: Who, how often, and why? *Ann Intern Med.* 1988;109:582–589.
3. Bellamy RF, Maningas PA, Vayer JS. Epidemiology of trauma: Military experience. *Ann Emerg Med.* 1986;15:1384–1388.
4. Blood CG, Puyana JC, Pitlyk PJ, et al. An assessment of the potential for reducing future combat deaths through medical technologies and training. *Trauma*. 2002;53:1160–1165.
5. Carey ME. Analysis of wounds incurred by U.S. Army Seventh Corps personnel treated in Corps hospitals during Operation Desert Storm, February 20 to March 10, 1991. *JTrauma.* 1996; 40(suppl 3):165–169.
6. Hoyt DB, Coimbra R, Potenza B, et al. A twelve-year analysis of disease and provider complications on an organized level I trauma service: as good as it gets? JTrauma. 2003;54:26–36; discussion 37.
7. MacKenzie EJ, Shapiro S, Eastham JN. The Abbreviated Injury Scale and Injury Severity Score: Levels of inter-and intrarater-reliability. *Med Care*. 1985;23:823–835.
8. Butler FK Jr. Tactical medicine training for SEAL mission commanders. *Mil Med*. 2001;166:625–631.

9. Butler FK Jr, Holcomb JB. The tactical combat casualty care transition initiative. *Army Med Dept J.* 2005;Apr/May/June:33–37.
10. Holcomb JB, Stansbury LG, Champion HR, et al. Understanding combat casualty care statistics. *Trauma*. 2006;60:397–401.
11. Baker SP, O'Neill B, Haddon Jr, et al. The injury severity score: Method for describing patients with multiple injuries and evaluating emergency care. *Trauma*. 1974;14:187–196.
12. MacKenzie EJ, Steinwachs DM, Bone LR, et al. Inter-rater reliability of preventable death judgments: The Preventable Death Study Group. *JTrauma.* 1992;33:292–302; discussion 303.
13. Department of Defense. DOD Personnel Procurement Statistics, 2005. Washington, DC: Department of Defense, 2005.
14. Salomone JP, Pons PT, eds. PHTLS Basic and Advanced Prehospital Trauma Life Support: Military Edition, 6th ed. St. Louis: Mosby, 2006.
15. Esposito TJ, Sanddal ND, Hansen JD, et al. Analysis of preventable trauma deaths and inappropriate trauma care in rural state. *Trauma*. 1995;39:955–962.
16. Holcomb JB. Fluid resuscitation in modern combat casualty care: lessons learned from Somalia. *JTrauma*. 2003;54(suppl 5):46–51.
17. Maio RF, Burney RE, Gregor MA, et al. Study of preventable trauma mortality in rural Michigan. *Trauma*. 1996;41:83–90.
18. Esposito TJ, Sanddal TL, Reynolds SA, et al. Effect of a voluntary trauma system on preventable death and inappropriate care in a rural state. *JTrauma*. 2003;54:663–669; discussion 669 – 670.
19. Walters TJ, Wenke JC, Kauvar DS, et al. Effectiveness of self-applied tourniquets in human volunteers. *Prehosp Emerg Care*. 2005;9:416 –422.
20. Wenke JC, Walters TJ, Greydanus DJ, et al. Physiological evaluation of the U.S. Army one-handed tourniquet. *Mil Med.* 2005;170:776–781.
21. Boffard KD, Riou B, Warren B, et al. Recombinant factor VIIa as adjunctive therapy for bleeding control in severely injured trauma patients: Two parallel randomized, placebo-controlled, double-blind clinical trials. *JTrauma*. 2005;59:8–15; discussion 18.
22. Lynn M, Jerokhimov I, Jewelewicz D, et al. Early use of recombinant factor VIIa improves mean arterial pressure and may potentially decrease mortality in experimental hemorrhagic shock: pilot study. *Trauma*. 2002;52:703–707.
23. McMullin NR, Kauvar DS, Currier HM, et al. The clinical and laboratory response to recombinant factor VIIa in trauma and surgical patients with acquired coagulopathy. *Curr Surg.* 2006;63:246–251.
24. Hedner U. Dosing with recombinant factor VIIa based on current evidence. *Semin Hematol.* 2004;41(suppl 1):35–39.
25. Wolberg AS, Allen GA, Monroe DM, et al. High dose factor VIIa improves clot structure and stability in model of haemophilia B. *Br Haematol.* 2005;131:645–655.
26. Moore EE, Johnson JL, Cheng AM, et al. Insights from studies of blood substitutes in trauma. *Shock*. 2005;24:197–205.
27. Hess JR, Holcomb JB, Hoyt DB. Damage control resuscitation: The need for specific blood products to treat the coagulopathy of trauma. *Transfusion*. 2006;46:685–686.
28. Holcomb JB, Jenkins D, Rhee P, et al. Damage control resuscitation: Directly addressing the early coagulopathy of trauma. *Trauma*. 2007; 62:307–310.
29. McMullin NR, Holcomb JB, Sondeen JL. Hemostatic resuscitation. In: Yearbook of Intensive Care and Emergency Medicine. Berlin: Springer-Verlag, 2006:265:–278.
30. Eastridge BJ, Jenkins D, Flaherty S, et al. Trauma system development in a theater of war: Experiences from Operation Iraqi Freedom and Operation Enduring Freedom. *JTrauma*. 2006;61:1366–1372; discussion 1372–1373.

The Intravenous Use of Coconut Water

Darilyn Campbell-Falck, MD; Tamara Thomas, MD; Troy M. Falck, MD; Narco Tutuo, MD; Kathleen Clem, MD

Republished with permission from Elsevier. Originally published in the *American Journal Of Emergency Medicine*, Vol 18, No 1, 2000, pp 108-111.

Medical resources routinely used for intravenous hydration and resuscitation of critically ill patients may be limited in remote regions of the world. When faced with these shortages, physicians have had to improvise with the available resources, or simply do without. We report the successful use of coconut water as a short-term intravenous hydration fluid for a Solomon Island patient, a laboratory analysis of the local coconuts, and a review of previously documented intravenous coconut use.

Atoifi Hospital is located on the South Pacific Island of Malaita in the Solomon Islands. Travel to the island occurs by small fixed wing airplane or boat. There are three hospitals located on Malaita, but travel between them is difficult because of the mountainous jungle topography and absence of roads. Atoifi Hospital is a 100-bed facility equipped with one operating theater and an outpatient clinic. Diagnostic resources include plain film radiography and minimal laboratory capabilities. A university medical team composed of five emergency medicine physicians and two surgeons traveled to Atoifi in September 1997 to provide relief work to the physicians and staff at this remote hospital. In addition to the requested lectures offered to the local physicians, we exchanged ideas about patient treatment and discussed innovative ways to face medical problems with limited resources. We learned about the resourceful use of intravenous coconut water during a hospital shortage of standard intravenous fluids usually obtained from Australia. Medical records were located for a case in which coconut water was intravenously given. We present this case, a laboratory analysis of the Atoifl coconuts, and a review of previously documented intravenous coconut use.

Case Presentation

Mr. I.A., an adult male subject in his forties, presented to Atoifi Hospital on November 23, 1999 with a one-day history of left-sided paralysis. While at home, he collapsed with no apparent precipitating cause and shortly thereafter experienced speech difficulties as well as left-sided weakness. He had experienced four similar transient episodes on previous occasions and had not sought medical treatment. He denied other medical problems, allergies, or medication use. He did have a history of tobacco use.

On physical examination, his vital signs were temperature 36.5°C, respiratory rate 24 breaths/minute, heart rate 72 beats/minute, and blood pressure 130/90 mmHg. Mr. I.A. was an awake, alert, cooperative patient who appeared generally ill. The lung examination revealed bilateral basilar crackles. Cardiac examination was remarkable for an irregularly irregular heart rate with a possible gallop. The patient was able to respond appropriately, but a left facial droop with pooling of oral secretions was noted. He showed left sided motor weakness in both upper and lower extremities. The remainder of the physical examination was normal. No computed tomography scan was available.

The patient was admitted to the hospital with the presumptive diagnoses of right middle cerebral artery stroke and atrial fibrillation and was treated with digoxin and aspirin. On hospital day two, he had difficulty with swallowing and standard normal saline intravenous (IV) hydration was initiated. Because the patient continued choking on liquids and solids, a nasogastric (NG) tube was placed for delivery of fluids, medications, and nutrition. The patient complained of discomfort and hiccups from the NG tube and refused the option of gastrostomy tube placement.

On hospital day 36, the patient became weak, shaky, and dizzy. He was unable to tolerate NG tube feedings because of vomiting and IV hydration again became necessary. The hospital had no standard IV fluids available and no capability of making their own IV fluids, and was not expecting new supplies for at least two days. The nearest hospital was located one day away by foot on the opposite side of the island. Additionally, the hospital did not have the financial resources to fly supplies from the capital city, Honiara, to Atoifi. The treating physician had heard of IV coconut being used successfully in other areas in the islands and at this time decided that their only option was to administer IV coconut water.

The patient received coconut water intravenously for approximately two days, at an estimated rate of

1,200ml/day. No follow-up serum electrolytes were recorded. He did eventually recover the ability to swallow and control his secretions and did not require further parenteral hydration and nutrition. He was discharged home on hospital day 39, December 30, 1992.

Discussion

The local Solomon Islanders describe six stages of coconut development from the immature *kabauro* progressing through *leuleu, bulo, zokelebuol,* and *rauka* to the most mature coconut *kopa.* Kabauro, the most immature coconut, contains less "meat" or endosperm and is mostly fluid. Leuleu, bulo, and zokelebuol have more mature meat and zokelebuol is the best to eat. As the coconut ages, the meat thickens and becomes tougher. Because the younger coconuts contain more fluid, these are generally chosen for intravenous fluid administration. Each coconut contains approximately 500 to 1,000ml of fluid. Coconut water is the free fluid present inside the coconut in contrast to coconut milk, the emulsion of fresh grated coconut and the water.

Relatives of the ill patient climb nearby trees and retrieve fresh coconuts, careful not to crack the coconuts, which would result in contamination of the fluid. The coconuts are then husked, leaving the "eye" portion intact until ready for IV set up. One large eye and two smaller eyes are seen at the base of the coconut. A 20-gauge needle is inserted through one of the smaller eyes to equalize pressure within the coconut. On first pass of the needle, coconut meat may block the needle lumen. A second needle is then passed through the same port. Single chambered blood transfusion tubing is then inserted through the large eye. The coconut set-up is placed in orthopedic netting, the base secured with tape to the netting to prevent slippage, and then hung for intravenous administration (Figure 1).

Because the drip rate is usually slow and difficult to regulate some find that IV boluses are more practical and are accomplished by aspiration from a port distal to the blood filter, to obtain filtered fluid.

Although not reported formally in the literature, the British in Ceylon and the Japanese in Sumatra allegedly first used coconut water as IV fluid during World War II.[1,2,3] In Havana, Cuba (1942), Pradera et al. showed no antigenic effects in humans or rabbits and administered this filtered fluid intravenously to 12 pediatric patients without adverse reaction.[4] The fluid infusion rate was 30 to 40 drops per minute, resulting in 24-hour volumes ranging from 1,000 to 1,870ml. With success, he also hypodermically administered up to 500ml of coconut fluid per patient in 13 patients; four patients experienced a local inflammatory reaction with no systemic reactions.

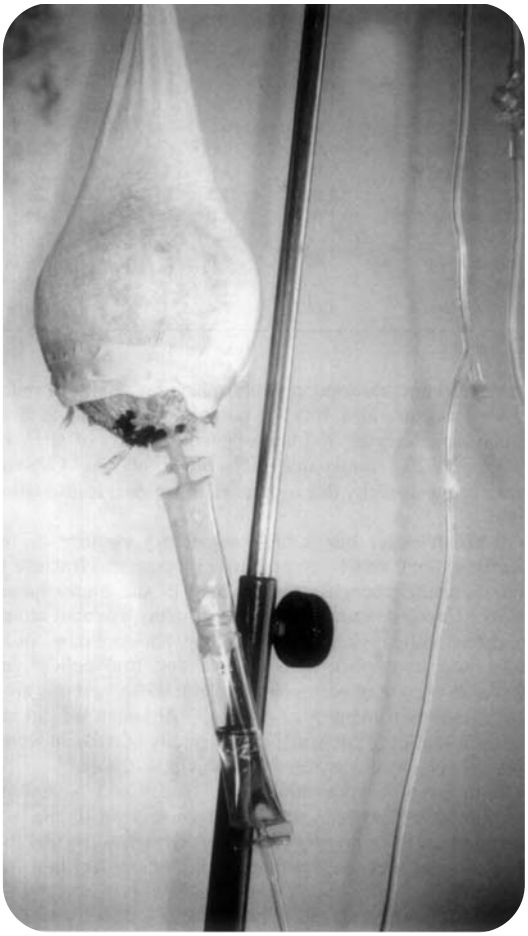


Figure 1. Intravenous coconut set-up. The coconut has singlechambered blood transfusion tubing attached, a second needle to equalize intra- luminal pressure, and is then placed in orthopedic netting.

In 1954, Eiseman conducted a prospective study in both Thailand and St. Louis in which 21 patients successfully received filtered IV coconut water without serious reactions.[3] He infused approximately 200 to 500 ml per patient over a period of 25 to 180 minutes. Patients experienced local infusion site discomfort at higher rates of infusion only.

Rajasuriya et al. also reported successful infusion of filtered coconut water in 26 Ceylonese patients.[5] Between 1965 and 1976, other investigators reported their use of intravenous coconut fluid in patients as well.[1,2,6] Iqbal; however, in 1976 reported successful direct infusion of water in Malaysia without any preliminary preparation or filtration system.[7] Since that time, coconut water has been studied only for oral rehydration use with no subsequent reports of intravenous use.

The authors brought representative coconut water to the United States for analysis. Electrolyte analy-

Table 1. Composition of Coconut Water

Study	Specific Gravity	pH	Na+ mEq/L	K+ mEq/L	Cl- mEq/L	Glu g/L	Ca_2+ mEq/L	PO_4 mEq/L	Mg_2+ mEq/L	Pro g/L
Pradera 1942[4]	1.018	—	5	64	45.5	1.2	17	2.8	—	—
Eiseman 1954[3]	—	5.6	4.2	53.7	57.6	1.8	9	2.4	17	1.56
Rajasurya 1954[5]	1.02	4.8	—	38.2	21.3	—	14.5	4.4	—	—
DeSilva 1959[8]	1.02	4.9	—	—	—	—	—	—	19	—
Olurin 1972[1]	1.02	5.6	0.7	81.8	38.6	—	3.6	3.2	25	0.049
Iqbal 1976[7]	1.019	4.8	5	49	63	2.1	12	8	4.7	1.8
Kuberski 1979[9]	—	—	4	35.1	41	2.8	13.1	4	5.2	2.69
Msengi 1985[10]	1.023	6	2.9	49.9	—	—	5.3	—	13.4	—
Atoifi 1997	—	4.2	9.7	43.1	39.8	1.73	—	—	—	—
Normal Plasma	1.027	7.4	140	4.5	105	0.1	5	2	1.8	60

sis was performed on the coconut water at a university medical center clinical laboratory. The coconut water was analyzed at three early development stages leuleu, bulo, and zokelebulo and the results were consistent with those reported previously (Table 1).[2,3,4,5,7]

The electrolyte composition of coconut water resembles intracellular fluid more closely than extracellular plasma. The predominant cations are potassium, calcium, and magnesium. Sodium, chloride, and phosphate are found in much lower concentrations. It is a hypotonic solution that is more acidic than plasma,[1] and has a specific gravity of approximately 1.020, comparable with blood plasma. Coconut water's hypotonicity does not make it the ideal resuscitation fluid.

Coconut water has a high osmolarity because of the sugars present, which are primarily glucose and fructose in the immature coconut, and sucrose in the more mature fruits.[2] Coconut water is also rich in many essential amino acids including lysine, leucine, cystine, phenylalanine, histidine, and tryptophan.[4] Cholesterol and triglycerides are absent or present in very small concentrations, and it is not a good source of vitamins or protein.[3,7] Although we did not perform studies to confirm the antigenicity of coconut water, this has been well documented in previous studies.[1,4]

With its high concentrations of sugar and potassium, coconut water has been studied extensively for its use as a potential oral rehydration solution. Although some feel that it is an ideal oral rehydration solution others feel that it is dangerous and the oral rehydration salts promoted by the World Health Organization and UNICEF should be used exclusively. Despite numerous studies and reports, a final consensus has yet to be reached on its use as an oral rehydration solution.[11,12,13,14]

The high potassium, calcium, and magnesium content are a concern in the intravenous use of coconut water particularly when given in fluid boluses. Olurin et al. showed rises in serum potassium levels by 1.5 to 2.8mEq/L, calcium levels by 0.6 to 2.0mEq/L, and magnesium levels by less than 1.0mEq/L after infusion of 2,000 to 3,000 ml of coconut fluid over 6 to 12 hours.[1] Additionally, he measured urine electrolytes and noted that the amount of excreted potassium, calcium, and magnesium increased as the amount of infused coconut water increased.

Because of the high potassium, calcium, and magnesium content, the patient's urine output, renal function, and cardiac status should be closely monitored. It would be contraindicated to use coconut water for patients with hyperkalemia from acute renal failure, rhabdomyolysis, or severe burns. It has been postulated that the high concentrations of calcium and magnesium minimize the neuromuscular effect of potassium because these cations have antagonistic physiological activity.[3]

The low pH may theoretically worsen an already present metabolic acidosis, common in many disease processes requiring IV fluids. However, studies have shown no change in pH measured within 24 hours after infusion of as much as 3,000ml of coconut fluid.[1] It appears that the body's buffering system effectively neutralizes the acidity of the coconut water.

The acidity, hypotonicity, and high potassium do not make coconut water the ideal resuscitation solution. In the cases reviewed there have been no adverse affects reported. Certainly, the cases reported in the literature detail ill, dehydrated patients in cholera epidemics, Nigerian civil war, and gastrointestinal illness in children and the concomitant absence of IV fluids.[1,9,12] Coconut

water does not appear to be an ideal solution for long-term resuscitation use but may serve as a temporizing alternative in urgent situations.

Conclusion

In conclusion, we report a case in which coconut water was administered intravenously in a Solomon Island patient without adverse effects. Coconut fluid has been shown to be an effective form of intravenous hydration solution in small volumes over short periods of time, and can be considered a temporizing alternative to standard intravenous fluids in remote areas where supplies are scarce and coconuts, abundant and inexpensive. Additionally, it is a good source of potassium, chloride, and calcium and its use could be further indicated in situations in which these specific electrolytes need to be urgently increased. However, further studies need to be conducted to substantiate the emergency use of coconut water for intravenous rehydration solution.

References

1. Olurin EO, Durowoju JEO, Bassir O: Intravenous coconut water therapy in surgical practice. *West Afr Med J;* 1972;21:124-131.
2. Goldsmith HS: Coco-nut water for intravenous therapy. *Brit J Surg;* 1962;49:421-422.
3. Eiseman B: Intravenous infusion of coconut water. *AMA Arch Surg;* 1954;68:167-178.
4. Pradera ES, Fernandez E, Calderin O: Coconut water, a clinical and experimental study. *Amer J Dis Child;* 1942;64:977-995.
5. Rajasuriya K, Hamza MHM, Selvaratnam S: *Ceylon Med J;* 1954;2:251.
6. Acharya VN, Gupta KC, GolwalaAF, et al: Comparative study of intravenous use of natural coconut water, synthetic coconut water and glucose saline in acute gastro-enteritis. *Ind J Mad Res;* 1965;53:1069-1073.
7. Iqbal QM: Direct infusion of coconut water. *Med J Malaysia;* 1976;30:221-223.
8. DeSilva CC, Perera PM, Dias AP: Coconut water. *Pediatria Int*; 1959;9:225.
9. Kuberski T: Coconut water as a rehydration fluid. *N Z Med J;*1979;90:98-100
10. Msengi AE, Mbise RL, Msuya PM, et al: The biochemistry of water from unripe coconuts obtained from two localities in Tanzania. *East Afr Meal J*; 1985;62:725-729.
11. Neto UF, Franco L, Tabacow K, et al: Negative findings for use of coconut water as an oral rehydration solution in childhood diarrhea. *J Amer Coil Nutr*; 1993;12:190-193.
12. Yartey J, Mphil, Harisson EK, et ah Carbohydrate and electrolyre content of some home available fluids used for oral rehydration in Ghana. *J Trop Pediat;* 1993;39:234-237.
13. Adams W, Bratt DE: Young coconut water for home rehydralion in children with mild gastroenteritis. *Trop Geogr Med*; 1992;44:149-153.
14. Sunoto: Home prepared oral rehydration solution. *Paediatr Indones*;1987;27:237-250.

Case Management Study
A 43-Year-Old Colonel with Chills, Diaphoresis, and Headache

LTC Michael J. Roy, MC USA; 2LT Javed M. Nasir, MSC USAFR

Previously Published in Military Medicine. 171. 4:340. 2006.

The objectives were to illustrate the ease with which one might attribute concomitant or subsequent illness to an exposure such as the anthrax vaccine and to demonstrate an approach that keeps the significance of such exposures in appropriate perspective. A 43-year-old, active duty, Army officer presents with a variety of nonspecific common symptoms and raises concerns about the relationship of his symptoms to receipt of the anthrax vaccine. He is admitted for an evaluation that includes a series of diagnostic tests and consultations. The course of his illness and the corresponding evaluation are reviewed using a series of questions and accompanying discussions to highlight key points regarding diagnostic considerations, the anthrax vaccine, and the ultimate identification of the correct diagnosis.

A 43-year-old, active duty, Army colonel presented to the emergency room at Walter Reed Army Medical Center with chief complaints of chills, nighttime diaphoresis, and a frontal headache. These symptoms started 2 days before presentation. The patient reported as many as six similar episodes, beginning in March 1999, while he was stationed in Germany. The medical history was otherwise noncontributory. All episodes were reported to be sudden in onset, and each was self-limited, gradually resolving within 72 hours with rest and/or over-the-counter cold remedies. Medical evaluation was sought in two cases and was unrevealing, with the symptoms attributed to a viral syndrome. In the 2 years before the initial episode, the patient's travel history included time in Germany, Israel, Crete, Austria, The Netherlands, Belgium, and South Korea. Upon admission to the medicine ward to facilitate diagnostic evaluation, the patient was afebrile; his physical examination was entirely unremarkable. Complete blood count, electrolyte levels, kidney function, blood urea nitrogen levels, creatinine levels, urinalysis results, and chest radiograph findings were within normal limits. The infectious diseases service was consulted, and screening for malaria was recommended on the basis of time spent in the field near the demilitarized zone (DMZ) in Korea.

1. Which of the following is not true about malaria?
    a. Malaria is transmitted by mosquitoes of the species Anopheles.
    b. *Plasmodium malariae* typically induces fevers at 48-hours intervals.
    c. Red blood cells infected by *Plasmodium ovale* appear enlarged.
    d. *Plasmodium falciparum* is the most pathogenic species of malaria.
    e. *Plasmodium vivax* is endemic to Korea.

Malaria is caused by protozoans of the *Plasmodium* genus. There are four species that are of significance among humans. i.e., *P. falciparum, P. vivax, P. 0va1e,* and *P. malariae*, of which *P. falciparum* is the most pathogenic. Female *Anopheles* mosquitoes transmit all species of malaria. Typical clinical manifestations include fever, chills, sweating, malaise, and a frontal headache. These symptoms are caused by pyrogens released when infected erythrocytes rupture and release their merozoites. This classically occurs at 48-hour intervals for *P. vivax* and *P.* ovale, at 72-hour intervals for *P. malariae,* and with an irregular pattern for *P. falciparum.*

Although a variety of immunologic tests are available, Giemsa-stained thick and thin smears represent the standard for ma1aria diagnosis. An experienced professional should review the smears, because false-negative results are quite common in practice. It is also possible to have false-positive results in endemic areas, because the parasites found may not be the cause of a concomitant fever. If parasites are identified, then several common traits allow speciation, including the parasite count, number of rings present per red blood cell, shape and / or presence of gametocytes, presence of Schuffner's dots, and size of the red blood cell. Because *P. vivax* and *P.* ovale preferentially infect reticulocytes, infected red blood cells are usually enlarged. Another trait specific to *P. vivax* and *P. ovale* is that these species can form exoerythrocytic hypnozoites that can remain latent in the liver for months or even years; in fact, a recent study found that one-third of travelers developed ma1aria >2 months after their return, despite the fact that most complied with prophylactic regimens.[1] Unlike other *Plasmodium* species. *P. falciparum* is able to infect all stages of red blood cell development, characteristically resulting in a higher parasite count. Definitive diagnosis of *P. falciparum* can be made through identification of distinctive banana-shaped gametocytes. Although *P. falciparum* does not exhibit relapse, infection by this parasite can exhibit recrudescence. This typically occurs when treatment falls to completely eliminate the blood stages of the parasite, leading to a subclinical infection that can reappear up to 2 years after the initial infection.

Malaria attributable to *P. vivax* is endemic to the Korean peninsula, with thousands of cases reported among U.S. troops during the Korean War.[2] Eradication efforts by the World Health Organization, in conjunction with the Republic of Korea government, successfully eliminated malaria from South Korea for more than two decades. However, a case of malaria was diagnosed in the Republic of Korea near the DMZ in the early 19908, and thousands of cases have subsequently occurred within the Republic of Korea. This

presents a significant problem for U.S. and Korean forces distributed along the DMZ, in which a number of cases have occured.[3] A study of 101 patients in Korea with symptomatic *P. vivax* malaria identified the most common clinical features as tertian fever (68.3%), headache (83.2%), and myalgias (42.6%). The median latent period was 278 days for the 77 patients for whom it could be estimated.[4]
The blood smear for malaria was negative. The patient's wife expressed concern that his symptoms were attributable to a series of three anthrax vaccinations, which were reportedly temporally associated with some of the initial symptomatic episodes ~ 1 year earlier. The patient had not received more recent anthrax vaccinations because of vaccine production problems that led to decreased availability.

2. Which of the following actions are recommended?
   a. Nasal swab for anthrax test, with initiation of empiric antibiotic therapy
   b. Careful skin examination for a necrotic eschar
   c. Chest radiograph to look for mediastinal widening
   d. Permanent waiving of all additional anthrax vaccinations
   e. Education of the patient and his wife about the anthrax vaccine

Anthrax is an infectious disease caused by the spore-forming bacteria *Bacillus anthracis.* Infection can involve the skin, the gastrointestinal tract, or the lungs. Cutaneous anthrax is characterized by a necrotic eschar, and inhalational anthrax most commonly causes hemorrhagic mediastinitis. Anthrax vaccination does not cause anthrax; therefore, diagnostic tests looking for evidence of anthrax are not warranted.

As a result of heightened concern over the potential use of *B. anthracis* as a biological weapon, the Department of Defense (DoD) began to administer the anthrax vaccine (anthrax vaccine adsorbed [AVA]) to service members in 1998. The AVA used by the DoD was developed by the Michigan Department of Public Health and is manufactured by the Bioport Corporation. The vaccine has been licensed by the Food and Drug Administration since 1970 and is made from filtrates of *B. anthracis*. As of October 1, 2002, >2 million doses had been administered to >500,000 individuals. Vaccine safety and efficacy have been reviewed.[5] As many as 30% of men and 60% of women note local tenderness, erythema, edema, and/or pruritus, which may persist for 2 to 3 days. Less than 1% experience systemic symptoms such as myalgias, headache, nausea, fever, chills, or malaise, which also may last as long as 2 to 3 days after immunization.

The administration schedule for the Anthrax Vaccine Immunization Program includes six shots, given at times of 0 weeks, 2 weeks, 4 weeks, 6 months, 12 months, and 18 months, followed by an annual booster. The DoD exempts individuals from vaccination for reasons of acute illness, recent surgery, pregnancy, immunosuppressive therapy, human immunodeficiency virus (HIV) infection or another chronic immunodeficiency, severe reaction to previous vaccination, or "other conditions." The latter category enables temporary vaccination deferral by a physician when a medical condition is being evaluated or treated. Possible vaccine-associated reactions fall into this category until a more definitive determination is made. For an AVA reaction to result in a permanent waiver, it must be deemed a severe reaction, such that additional doses would pose an undue risk to the vaccine recipient.[6] Although there is considerable ambiguity concerning what constitutes a severe reaction or poses an undue risk, the frequency of mild side effects has been published by the Centers for Disease Control and Prevention National Immunization Program[7] (Table1).

Although it is plausible that the vaccine was responsible for the systemic symptoms that were reported to occur in close temporal association with vaccine administration, there is no evidence that the vaccine causes such symptoms months or years later. The available data regarding vaccine side effects should be provided to concerned patients, and their questions should be answered as clearly and fully as possible. The Anthrax Vaccine immunization Program world wide web site may facilitate this (http://www.anthrax.osd.mil/default.asp).
The immunology service was consulted to evaluate the potential relationship between the anthrax vaccination and the patient's symptoms. The consultants concurred with the impressions of the primary care team that the nature of the patient's current symptoms, and the long period of time since his last vaccination, rendered a relationship between his symptoms and vaccination extremely unlikely.

3. As the primary care manager for this patient, what should you do if your patient wants to report his reaction to the vaccine?
   a. Tell the patient that a report cannot be filed because his fever was not documented.
   b. Tell the patient that a report cannot be filed because his side effects are not severe.
   c. Discourage the patient from filing a Vaccine Adverse Event Reporting System (VAERS) report because his episode is not related to his anthrax vaccination.
   d. File a VAERS report on behalf of the patient.
   e. Instruct the patient that only allergists can use the VAERS-1 Form.

The VAERS, cosponsored by the Food and Drug Administration and the Centers for Disease Control and Prevention, has been used since 1990 to facilitate collection of data on vaccine side effects. The VAERS-l form is used by the DoD, in conjunction with service-specific channels, to report AVA side effects.[6] To fully understand the frequency and scope of potential side effects of the vaccine, it is important to

try to report all cases of potential concern. This includes cases in which the findings are mild or in which the vaccine seems less likely than another cause to be responsible for the presentation. Although patients can file VAERS reports on their own, to improve accuracy it is preferred that healthcare professionals take an active role in the reporting of cases to the system.[8] The Assistant Secretary of Health and all branches of the service have issued statements encouraging physicians to file reports with VAERS to create a complete database.[6] Any healthcare professional can file a VAERS report. Through April 2002, 1,857 VAERS-l reports had been filed, of which 966 cases were judged to be certainly or probably caused by the anthrax vaccine. Eleven of those individuals were hospitalized, all because of allergic inflammatory reactions at the injection site.

Table 1

FREQUENCY OF COMMON ANTHRAX VACCINE SIDE EFFECT'S

Side Effect Description	Approximate Frequency (%)
Lump at Injection site	50
Muscle or Joint aches	20
Headaches	20
Fatigue	Men, 7; Women, 17
Chills or fever	5
Nausea	5

The patient remained afebrile during 3 days of evaluation in the hospital. Consultations from infectious diseases, immunology, and neurology services did not identify a cause for his symptoms. Lumbar puncture and computed tomographic scans of the head and sinuses were unremarkable. However, liver chemistry tests demonstrated a slightly elevated unconjugated bilirubin level of 2.2mgldL (normal range, 0.0-0.9 mg/dL) at the time of admission and alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels that increased from their normal initial levels to 125 U/L (normal range, 9-52 U/L) and 124 U/L (normal range, 14-50 U/L), respectively, at the time of discharge.

4. What tests would you order at this point?
   a. Hepatitis A, B, and C serological tests
   b. Serum ceruloplasmin levels
   c. α_1-Antibypsin levels
   d. Urgent ultrasound for bile duct obstruction
   e. Liver biopsy

Liver chemistry tests are nonspecific but, in the absence of other definitive abnormalities, they can provide direction in the search for a cause of nonspecific systemic symptoms. In this case, the changes were acute and were at least temporally, and quite possibly causally, related to the patient's recent symptoms, and the pattern of transaminase level elevations indicated potential hepatocellular damage. This should lead to consideration of viral infections, as well as the effects of medications, dietary supplements, or other toxins. Screening for genetic anomalies such as Wilson's disease (screened for by checking serum ceruloplasmin levels) or α_1-antitrypsin deficiency is warranted in cases of chronic elevations. In addition, one of the more common causes, known as nonalcoholic fatty liver disease (previously called nonalcoholic steatohepatitis), is related to fluctuations in weight. In a case like this, where the history and physical examination results are unremarkable and there are relatively mild, acute elevations of the ALT and AST levels, it is reasonable to perform additional serological evaluation for acute infectious diseases, especially in the setting of symptoms that might be explained as a result. However, the pattern of liver chemistry test elevations was not consistent with an obstructive pattern, which would elevate the alkaline phosphatase and bilirubin levels to a greater degree than the aminotransferase levels. Liver biopsy can provide significant additional information and can influence management,[9] in the presence of chronic aminotransferase elevations and the absence of diagnostic serological findings; however, it is not warranted in the setting of acute mild elevations.

At an outpatient follow-up visit 1 week after discharge, the patient had returned to his usual state of good health and the ALT and AST levels were returning to normal. However, because of the nonspecific nature of his initial symptoms and the short-term transaminase elevations, as well as the fervent desire of the patient and his wife for an explanation for the symptoms, acute serological tests for Epstein-Barr virus (EBV) and cytomegalovirus (CMV) were obtained. They were notable for elevated levels of IgM antibody to CMV, consistent with acute infection.

5. Which of the following is not a characteristic clinical manifestation of CMV infection?
   a. Asymptomatic
   b. Acute mononucleosis-like illness
   c. Elevation of liver transaminase levels
   d. Retinitis
   e. Burkitt's lymphoma

CMV is a member of the herpesvirus family. It is spread by person-to-person contact, with transmission occurring via both saliva and sexual contact. CMV infection is extremely prevalent. In developed countries, congenital infection rates are estimated at 1% and prepubescent infection rates at 10 to 20%; rates of previous exposure among adults range from 40% to 100%, with higher rates in developing nations.[10] CMV diagnosis can be made through culture of the organism from blood, urine, and other body fluids, and also through polymerase chain reaction.

For the vast majority of people with competent immune systems, CMV infection is asymptomatic. The most common symptomatic presentation among immunocompetent patients is an acute mononucleosis-like illness. In fact, although EBV is thought to be the most common cause of acute mononucleosislike illness, CMV was nearly as common in some studies.[11] Other potential causes include human herpes virus type 6, *Toxoplasma,* and HIV. Liver transaminase levels are typically mildly elevated in CMV mononucleosis syndrome, with AST usually peaking below 200 U/L.[12] Among immunocompromised patients, CMV infection can be a serious illness. CMV retinitis occurs for 30% of patients with acquired immunodeficiency syndrome in the United States and can progress rapidly unless treated. CMV infection is also associated with rejection of transplanted organs. EBV, but not CMV, is associated with the development of Burkitt's lymphoma.

Discussion

Malaria afflicts travelers (including Soldiers) in many parts of the world, including the Republic of Korea. It can present weeks to months after the return from being overseas and is often missed by U.S. physicians. A careful travel history is vital, and, if malaria is considered, then physicians should have a low threshold for ordering thick and thin smears. However, relatively few laboratory technicians in the United States have significant expertise in the interpretation of these smears, and careful review by experts is important.

Case Management Study

The anthrax vaccine is relatively well tolerated by most individuals, but some do experience serious side effects. In addition, misinformation on the Internet and in lay publications is rampant, leading some individuals to fear the vaccine and others to attribute a host of symptoms or illnesses to their receipt of the vaccine. The symptoms are unrelated to the vaccine in most cases, and a careful history, physical examination, and directed laboratory testing are warranted to try to identify the cause of the presenting symptoms. In many cases, another cause may be identified or no clear cause found; nevertheless, it is helpful to report the temporal association through the VAERS system, with all pertinent clinical data, to establish a meaningful clinical database.

CMV is a member of the herpesvirus family and is highly prevalent in the general population. Although most cases are asymptomatic, it can become a serious disease among immunosuppressed patients. Among immunocompetent adults, CMV can produce a mononucleosis-like syndrome, with a variety of nonspecific complaints that can be mistaken for influenza or other viral processes, or numerous other common clinical syndromes. This infection has additional military relevance, in that it can be easily disseminated among young adults in close quarters, such as new recruits in basic training barracks, where contact with respiratory secretions and other bodily fluids may occur. In the case presented, CMV is thought to be the cause of the patient's most recent episode of symptoms. Some of his previous similar episodes might have been attributable to administration of the anthrax vaccine, whereas others were most likely attributable to unidentified viral causes, highlighting the nonspecific presentation that is common with CMV.

Answers

1) b; 2) e*;* 3) d; 4) a; 5) e

Acknowledgments

We thank CPT Jay Bucci, MC, and CPT Erik Rupard. MC. of the Department of Medicine at Walter Reed Army Medical Center. for their assistance In the preparation of this article.

References

1. Schwartz E. Parise M. Kozarsky p. Cetron M: Delayed onset of malaria: implications for chemoprophy1axls In travelers. *N EngI J Med* 2003; 349: 1510-6.
2. Hankey DD, Jones R. Coatney GR. et al: Korean vivax malaria. I: Natural history and response to chloroquine. *Am J Trop Med Hyg* 1955; 2: 958-69.
3. Feighner BH, Pak SI. Novakoski WL, Kelsey LL, Strickland D: Reemergence of *Plasmodium vivax* malaria in the Republic of Korea. *Emerg Infect Dis* 1998; 4:295-7.
4. Oh M. Shin H. Sin D. et al: Clinical features of vivax malaria. *Am J Trop Med Hyg* 2001; 65: 143-6.
5. Friedlander AM. Welkos SL. Ivins BE: Anthrax vaccines. *Curr Top Microblol Immunol* 2002; 271: 33-60.
6. Office of the Assistant Secretary of Defense-Public Affairs: Anthrax Vaccine Immunization Program: current polices. Available at http://www.anthrax.osd.mft/resource/polides/CUNcurrent.asp; accessed May 21.2003.
7. Centers for Disease Control and Prevention: Vaccine side effects. Available at http://www.cdc.gov/nip/vacsafe/concerns/side-effects.hlm'anthrax; accessed May 21. 2003.
8. Chen RT, Rastogi SC, Mullen JR, et al: The Vaccine Adverse Event Reporting System (V AERS). Vaccine 1994: 12: 542-50.
9. Skelly MM, James PD, Ryder SD: Findings on liver biopsy to investigate abnormal liver function tests in the absence of diagnostic serology. *J Hepatol* 2001; 35:195-9.
10. de Jong MD, Boucher CA. Danner SA, et al: Summary of the II International Symposium on Cytomegalovirus. *Antiviral Res* 1998: 37: 1-16.
11. Tsaparas YF, Brigden ML, Mathias R, Thomas E, Raboud J, Doyle PW: Proportion positive for Epstein-Barr virus, cytomegalovirus, human herpesvirus 6, *Toxoplasma*, and human immunodeficiency virus types 1 and 2 In heterophile-negative patients with an absolute lymphocytosis or an instrument-generated atypical lymphocyte flag. *Arch Pathol Lab Med* 2000; 124: 1324-30.
12. Horwitz CA. Henle W, Henle G: Diagnostic aspects of the cy tomegalovirus mononucleosis syndrome in previously healthy per sons. *Postgrad Med* 1979; 66: 153-8.

Viet Cong Medicine

Arthur Mason Ahearn, MD
Republished with permission from Military Medicine. Originally published in *Military Medicine, March 1966, Vol. 131 No. 3.*

Introduction

Any discussion of Viet Cong facilities and activities is subject to strict security control. Much of the documented information on Viet Cong medicine is at present c1assified and cannot be printed. What follows is a combination of the author's personal experience, informal reports from colleagues, and information from unclassified reports. It is hoped that it will serve as an enlightening, if brief, introduction to some of the medical practices of our enemy in Vietnam.

Personnel and Training

Physicians are, of course, quite scarce. Prior to the Geneva Partition of 1954 the French trained many of the doctors now practicing with the Communists in both North and South Vietnam. Now they must train their own, relying upon their own resources and upon technical assistance from nations sympathetic to them. The Viet Cong have augmented their shortage by establishing a twelve month school for "medical officers" in a safe area hidden in the jungles. Candidates have completed basic aid cycles and have served with troops in the field. In the school they are taught the structure and function of the organ systems, basic diagnosis and treatment, and traumatic surgery. The program is quite similar to that studied by the U.S. Army Special Forces Medic. It would appear that the instruction is largely didactic with little emphasis upon practical work or student contribution.

Nurses, midwives, aids, cooks, and bearers also fit into the medical organization. In addition to their professional training, these workers are so impressed with the patriotic aspects of tending and comforting their fallen comrades that they bring an amazing zeal to the bedside.

Battlefield Practices

The guerilla is quite concerned about his wounded. Outnumbered as he is, he can less afford his losses than can his conventional opponent. Moreover, wounded and dead constitute important sources of intelligence which he little cares to give his enemy. Accordingly the Viet Cong make every effort to retrieve their casualties. In many areas they attack with one leg wrapped in a length of vine. This vine permits the soldier to be dragged hastily from the field should he fall. A hook similar to that used by stevedores has also been used on dead and seriously wounded soldiers. This is inserted under the chin and serves as another dragging device. Viet Cong medics brave defending fire during attack lulls to extricate wounded and dead from wire entanglements. In some areas U.S. Soldiers have been surprised to note that when one Viet Cong is hit, his two adjacent comrades quit the fight and assist him to the rear. It must be remembered that the Viet Cong usually attack in vastly superior force.

It is evident that some triage is performed on the battlefield. Although no eye-witness accounts of dispatch have reached the author, there are numerous reports of Viet Cong dead bearing serious body-cavity wounds, who also have neat gun-shot wounds of the head.

Individual aid kits usually contain a dressing, chloroquine tablets, an antibiotic powder, and a handful of herbs for a stimulating tea. Unit level aid kits contain surgical instruments, frequently Chinese, and assorted antibiotics, vitamins, and stimulants, usually nikethamide preparations. Medicines are almost always in parenteral form due to the Vietnamese preference for the intravenous route. This preference reflects the French influence.

Following a sustained attack, defenders always find an area used by the Viet Cong as a forward aid station. Discarded items indicate that the treatment here is limited to dressings, life-saving procedures, and administration of antibiotics. No use of plasma expanders has been reported.

Forward Hospitals

Specific information on numbers, locations, and organization of forward hospitals is, of course, classified. However, it is safe to state that many forward hospitals

do exist in Viet Cong safe areas. Here definitive treatment must be administered.

The patient is prepared for surgery with a stimulant -- again usually nikethamide. Anesthesia is by a combination of intravenous induction agents and local infiltration. The dripping of procaine on exposed tissue has been described. There is no evidence of inhalation equipment, and only rarely is the use of open-drop ether reported.

Descriptions of debridement indicate that the Viet Cong have a full knowledge of ballistic injuries. Surgeons have described several techniques of intestinal anastomosis. Although the danger of infection is great, some orthopedic cases are handled with internal fixation devices. However, amputation is frequently the treatment of choice.

Captured equipment indicates that routine laboratory procedures on blood, urine, stool, and smears is available at these hospitals.

It should be noted that some definitive treatment is received by Viet Cong in hospitals of the South Vietnamese civil government. The guerilla's technique of blending in with the civilian population makes it possible for him to feign refugee status and to secure treatment in the hospitals of his enemy.

Evacuation

Evacuation to the rear proceeds backwards up the "Ho Chi Minh Trail." In the delta, the sampan affords easy transportation and ready concealment. In flat lands, a favorite conveyance is a litter mounted between two bicycles. In jungle and mountainous areas, transportation is via human and animal bearers. The trail is constructed in a similar manner to the mission highways of old with way-stations spaced a day's journey apart. Members of the local population are frequently impressed into service between two of these way-stations carrying supplies forward and wounded backward. Doubtless many a Viet Cong has enjoyed the dubious luxury of an elephant ambulance.

Drugs

The Viet Cong secure their pharmaceuticals through several channels. Their own supply system is one of these. Another is the black market in South Vietnam. In Danang a 250mgm tetracycline tablet sells for 28 piasters or about 23 cents. Another channel is that of the legitimate South Vietnamese drug market. Most items sold by prescription only in the United States can be purchased openly in Vietnamese drug stores. Tifomycine (chloramphenicol) is featured in display windows, and highway billboards sport advertisements of anti-helminthics complete with attractive illustrations of the parasites. This ready access alarms officials who are concerned with resources control.

In addition to western pharmaceuticals, the Viet Cong employ a battery of herbs and native medicines. A medical missionary working in a Montagnard area has reported that he suspects the Viet Cong of using a crude digitalis preparation to poison their enemies, due to the slow pulse, vomiting, and cardiac irregularities of the victims.

Other Practices

The Viet Cong employ the same oriental techniques as do their non-communist countrymen. Needles and bits of glass are used to prick the skin in a pattern determined by the nature of the malady. Glass bottles are heated and applied to the skin so that the suction generated as the contained air cools may draw the evil agents from the body.

Downright sorcery is popular in Montagnard areas. Figure 1 shows a sorcerer at work in a friendly Montagnard village. His patient is suffering from cholera in the nearby hut. He has just allowed chicken blood to run down the bamboo stakes, and now he is consulting rice grains in his palm to determine the correct incantation. Meanwhile, a medical missionary is within, treating the patient with fluids and antibiotics. The combination in this case was successful.

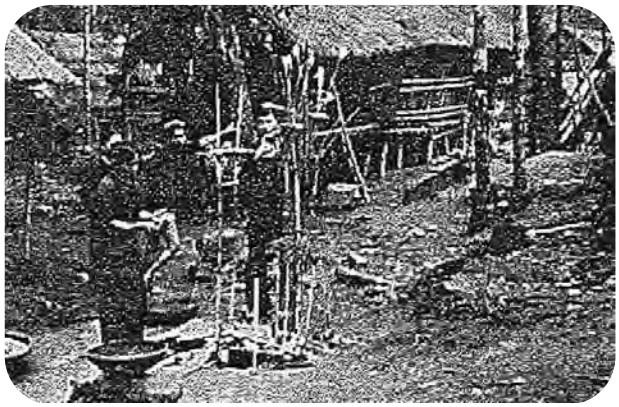


Figure 1. A Montagnard sorcrer treats a patient with cholera by consulting grains of rice in his hand.
Photo by Dr. Eric Stuart Harverson

Public Health and Civic Action

The Viet Cong are quite conscious of public health, and they employ the principles of sanitation extensively in their civic action and propaganda efforts. During the recent flood in the Danang area, they launched an intensive campaign to educate the villagers about the dangers of water pollution and measures to be taken to

protect water and food from contamination. Such slogans as "Prevention of Disease is Patriotism," and "Prevention of Disease is Fighting the Americans" have been observed. In addition to public health instruction, medical civic action usually consists of a basic village sick call which is conducted simultaneously with a political propaganda session.

Conclusion

In summary, the tendency to downgrade the extent and effectiveness of the Viet Cong medical operation should be avoided. Although it is true that in many aspects Viet Cong medicine is at a level parallel with American medicine during our Civil War, it is believed that if the full truth were known, all would be amazed at the quality of medical care they are able to give their sick and wounded.

Acknowledgments

The assistance of: Lieutenant Colonel Valentine B. Sky, Surgeon, 5th Special Forces Group (ABN) was greatly appreciated. Also of value were the reported experiences of the other Special Forces Corps Surgeons, Captain Larry Waterbury, Captain Barton D. Urbauer, Captain Robert L. Henderson, Captain Roger P. Hand, and Captain Sergio E. Betancourt. Finally, the contributions of Dr. Eric Stuart Harverson, Worldwide Evangelization Crusade, are gratefully acknowledged.

Formerly Medical Officer, Operational Medical Detachment, 5th Special Forces Group (Airborne), 1st Forces, CPT Ahearn obtained his education at the Pingry School, the University of Rochester, and Cornell University College of Medicine. He began active duty in the Army following a surgical Internship at the University of Chicago Hospital. After airborne training and six months of duty with the 82nd Airborne Div., CPT Ahern joined the U. S. Army Special Forces. He graduated from the Unconventional Warfare School at the U. S. Army John F. Kennedy Center for Special Warfare, Fort Bragg, NC. After a brief mission in west Pakistan, CPT Ahearn was assigned to the 5th Special Forces Group (ABN) in Vietnam. As surgeon to a "C" detachment in I Corps he supervised the medical civic action and counterinsurgency efforts of his detachment and its subordinate "A" detachments. At the conclusion of his tour, CPT Ahearn was awarded the Vietnamese Honor Medal, First Order, for exceptionally meritorious service.

The Function and Functioning of a Surgeon in Guerilla Warfare

Geoffrey Parker, MD, FRCS, DSO; Croix de Guerre; Chevalier de la Legion d'Honneur

Republished with permission from the Editor, *Journal of the Royal Army Medical Corps* (MM. Lewis, Colonel, RAMC)

APPENDIX I
Medical Service in Unconventional Warfare; Vol LXXXVII; September, 1946

I would like to start this short article by asking and trying to answer the first question which naturally presents itself. In what way does this sort of medical work resemble, and in what way does it differ from, that of the medical services of a regular army?

The function of the medical services in both cases is the care and maintenance of the major sick and wounded and the rapid repair of the minor cases, so that they may rejoin their units, properly reconditioned, as soon as possible.

Having said this, the differences in the two services, or regular and guerilla warfare, must be emphasized, and this will involve me in a short discussion on the subject of "total war."

This is a term often loosely applied by those who, far from a theater of war, have yet suffered from the vagaries of indiscriminate bombing or the chance tragedies resulting from a fighter-harassed bomber jettisoning its load while on its way to a military objective. This may be "war on the home front" but it is not "total war." Civil and guerrilla warfare alone constitute "total war," with all its hideous implications.

Here, there are no "rules" except those of the jungle. Torture and death is the fate of all prisoners, wounded or unwounded. Enslavement, torture, and death is the rule, too, for the family of any man or woman who dares to lift a hand against an occupying army. The wives and sisters are sent to the soldiers' brothels, and the children and old people to the labour concentration camps, from which only a small percentage will return with their minds and bodies permanently damaged to a greater or lesser extent.

Guerilla fighting, therefore, attains a degree of bitterness which is unknown in classical warfare, except during those rare moments of hand-to-hand fighting.

The next points of difference are in the matter of the composition of a guerilla force, its morale, and its discipline.

The aetiology of such a force varies in each component individual. Simple unquestioning national patriotism, political hatred of the enemy's way of life, a desire for vengeance for atrocities committed on loved ones, and, rarest of all (and the least reliable source of inspiration), a spirit of pure adventure. Each and all operate as individual members of such a force. Each fights by reason of his or her convictions or from necessity. However, the aetiology may differ the mass effect is the same: a force which is quite unconquerable so long as it lives, not only collectively but as individual men and women. The high morale of these people is something which has to be lived with to be appreciated.

So long as there is work to be done and enemies to be killed, the tireless and irrepressible courage of these ragged patriots made me think many times of Tolstoi's axiom that wars are won, not by preponderance of guns, nor even by brilliant generalship, but by the fighting spirit of the soldiers engaged.

Lastly, the question of discipline and its maintenance, a factor with which morale is intimately linked.

There are no A.C.I.s or Part I and II orders in a guerilla force. Orders are given, for the most part, by word of mouth. There can be, therefore, no fine grades of obstruction to, or evasion of, orders received. Either an order is obeyed or it is defied, and so, accordingly "field punishment" is reduced to its simplest and grimmest forms. Immediate execution was sometimes threatened though rarely resorted to, except for acts of cowardice or treachery. Dismissal from the force was sometimes ordered, and this might well mean an indirect death sentence since the dismissed man could no longer rely on the protection of numbers of his compatriots about him, and stood a good chance of being picked up by the enemy who would still treat him as a guerilla. He was left to survive, if he could, in a land, where the hands of foes and former friends alike were turned against him.

In a preceding paragraph I have described the secret of maintenance of discipline, as I saw it practiced by our own "chief" in France, Colonel Roman, D.S.O., a Frenchman of prodigious energy and fantastic personal courage of which I was a privileged witness on more than one occasion. He rarely gave us, or the enemy, a day's nor yet an hour's peace.

An active guerilla force is well disciplined, but a period of idleness is even more disastrous to it than it is for a regular force. The keen men are bored and frustrated, and so drift away to more active units in other

parts of the country; while the poorer types, whose motives for being in the irregular force are often mixed ones, will swagger round in idleness, recounting their past deeds of valour, drinking too much, and displaying their arms, more for the appreciation of the local women than the destruction of the enemy. Such a force, when again put suddenly to the test of battle, will disintegrate completely in a matter of hours.

Our chief's policy was therefore one of perpetual movement, and often in this intention it must be said he was assisted by the attentions of the German occupying forces. As soon, however, as the attacks slackened off, acts of sabotage and assaults on the enemy lines of communication were at once organized, and so a busy time was had by all, and little opportunity for the demoralization of idleness. The morale of the men, therefore, was kept constantly at a very high pitch. The Maquis were completely irrepressible, and it was a perpetual tonic to be with them. No opportunity for making jokes of their own misfortunes was allowed to pass. At times this effervescense bordered on the hysterical, but this was entirely spontaneous and genuine. A remarkable phenomenon in a group of men and women who fought without hope of mercy if captured, and who knew that the very fact that they were there at all was an automatic death sentence not only for themselves but also for their families, if they were identified.

I must apologize for this preamble, but it has a direct bearing on the work of a surgeon who finds himself engaged with a guerilla force. In the first place, he must try always to be on the spot where the actual fighting is taking place, and this may well be difficult when unexpected contacts with the enemy occur in widely separated areas.

The effect on the morale of these irregular fighters of the presence of a few men or women with even the elements of medical training is entirely out of proportion to the actual medical services that they may be able to render to the sick and wounded. This is fortunate because, generally speaking, the medical service can only be of the simplest kind, and might be classed as "high grade first aid." Of course, the fighting men know this, nevertheless it is just one more small barrier between them and death, and it means much.

In the second place, there is no such thing as "evacuation of the wounded" in a guerilla army. The medical man must be prepared to carry his cases about with him, or hide them securely in the forest country, if any, or in the cellars of remote farms, where loyalty to the cause is unquestioned. Even in these "hideyholes" he must continue to feed, water, and treat his cases, as no one else not actually involved with guerillas will dare to do so for fear of reprisals on themselves and their defenseless families.

In the third place, the medical man must be prepared to fight in defense of his wounded and of himself. He does not wear a uniform, and he must carry arms and use them. He is, therefore, violating international law (whatever that may mean), and he and his patients will die together if they have the misfortune to be captured. This is not the place for discussion or comment on the ethics of all this; but the above are facts which must be taken into consideration of this type of medical work if it is to be done well.

I seem to have wandered again from the main purpose of this article, but I have tried in a few words to give a picture of the "material" on which the guerilla surgeon will find himself at work, and I will come now to a more detailed study of purely medical consideration.

The first questions that a doctor must ask himself when setting out for this type of warfare are, "What shall I take with me?" and '"What shall I find to use when I get there?" The answer to the first question is "Nobody knows better than he does, even if nobody knows less," and to the second "Nobody knows at all."

In dealing with these questions myself, therefore, I made the following plans. I divided my medical equipment into two groups: the first consisted of the maximum of bare essentials that, at a pinch, I could carry on my own back in a highly mobile war "on the run" and the second consisted of the maximum that they would allow me to take in the plane which was to carry me to my destination.

The load to be carried in a rucksack on the back consisted of:

(1) One canvas surgeon's roll (American pattern). A superbly well-thought-out set containing about 40 stainless-steel instruments (including a small ophthalmic set) with which it was possible to do any major or minor surgical operation that might be encountered in war.

(2) Metal spools carrying 100 feet of linen thread and silk for ligatures.

(3) 300-one gram ampoules of penthothal sodium.

(4) 200 compressed shell dressings (regulation pattern).

(5) 100 grains of morphine sulphate in 5 grain tablets.

(6) 2 lb of sulphanilamide tablets (to be crushed up for local application) in two light metal containers.

(7) 50 packets of compressed wool (to be used as "sterile swabs") for operating.

(8) One 10cc all-metal syringe and needles.
(9) One spare shirt and two pair~ of socks and mending material.

In addition, a .45 Colt and 50 rounds, and a dagger (commando pattern) were carried, and to this was added a small automatic rifle and 200 rounds on arrival in France.

I had no time to do a trial loading before leaving England, and when it came to the point of actually carrying this, I found myself defeated by the bulk rather than the weight, and had to part with 100 ampoules of pentothal, 100 shell dressings and one pound of the sulpha tablets. Another man took charge of those for me, and in the confusion of a sudden retreat into the forest I lost sight of him and the stores for many weeks, but both turned up safely later on.

The "bulk" packing to be carried on the airplane was limited in weight as many other things such as explosives, ammunition, chocolate, cigarettes, etc., had to be taken and either dropped by parachute or landed with us. I limited myself, therefore, to half a dozen Thomas' splints (paratroop collapsible pattern), 500lb of Cellona plaster bandages, 10 metal bottles of chloroform (ether was not permitted on the plane, for obvious reasons), 50lb of carbolic soap, and 20 "first-aid sets." These latter were not "combat" packed, i.e., as separate units; some contained only instruments, others only drugs or dressings, etc., and they all had to be hastily unpacked and reassembled on arrival. When this was done, each set contained:

(1) Three pairs of artery forceps.
(2) One knife and one pair of dissecting scissors.
(3) Six first field dressings.
(4) Six packets of compressed wool.
(5) Two ampoules of penthothal.
(6) Ten grains of morphia in 5 grain tablets.
(7) Some sets had a metal syringe (5cc).

Tourniquets were supplied with sets, but I did not issue them as I think that they are a source of great danger in the hands of the semi-trained. These first-aid sets were for distribution to any medical students, doctors, nurses, whom I hoped to have to work with me, and they proved of the greatest value in the later stages of my time in France.

It was my intention to distribute these sets, together with extra first field dressings, and plaster bandages, to the young medical students and nurses who were working with the Maquis, to be taken when they were operating with small groups of from five to twenty men carrying out isolated acts of sabotage, etc.

In actual practice nearly the whole of my "bulk stores," such as they were, were overrun by the Germans within four days of my arrival, though most of it was safely hidden and recovered later.

The area where I was working was heavily attacked by two and a half German Divisions including some armored car units and two battalions of SS, so the Maquis broke up into small groups, and we ran for our lives into the forest, taking about eighty wounded with us. Nine of our wounded I failed to extract from a hospital before the Germans arrived; they were caught and executed under particularly brutal circumstances by the Wehrmacht.

As soon as possible, that is about nine days after this dispersal in the forest, code messages were sent to England for further medical supplies, together with antiscorbutic tablets (as I found a number of the younger Maquis suffering from minor degrees of scurvy). In due course these supplies, together with a number of other things, were dropped to us by parachute in. the night in the mountains.

At this stage in the fighting, we only took with us such wounded as were incapable of doing anything for themselves but were at the same time fairly mobile. The rest we hid in little groups of two or three, either in the denser parts of the forest or in remote farmhouses. The latter was the more dangerous method, as there was the perpetual and very real risk of informers and a search by German troops, when, if the Maquisards were found, or indeed, any trace that they had ever been there, the farmer and his family would be executed and the farm itself razed to the ground.

The care of these widely separated groups of wounded was particularly difficult, and the half-dozen doctors, students, nurses, and I must, between us, have crept many hundreds of miles along the forest tracks at night to visit them every three or four days.

The surgical treatment of these cases might be described as an oversimplified form of the Trueta principle as he first described it, during the Spanish civil war. All wounds were laid widely open and, when in doubt about an amputation, then an amputation was done. Possible late complications had to be cut down to a minimum, and neither immediate closure nor secondary suture was ever considered safe and practical owing to the difficulties of postoperative supervision. The sulpha drugs could be applied locally and given by mouth for a few days.

Plaster of Paris bandages were in very short supply, and I could only use them where there was a fracture complicating the wound. For strengthening, and also

for economy in plaster, pieces of wood or small branches of trees were incorporated in the plasters and in cases where the plaster casing might be easily visible, such as, for example, a light thoracobrachial plaster, the surface of the casing was rubbed over with earth and leaves to camouflage the man when moving through the woods in daylight.

I found among the cases already wounded before I joined the Maquis, three cases of dropfoot. Two were GSW of the sciatic and external popliteal nerve respectively, while the third was a GSW of the thigh with a fractured femur in a man who had lain hidden and untreated in the woods for about ten days. All three cases had been hit many weeks before I arrived, and their wounds were soundly, though untidily, healed, and there was early union in the fractured femur (middle third) in almost perfect position. The cases presented a problem however, because they could not walk and had to be supported or carried around wherever we went.

With the aid of an ordinary dog collar round the leg above the knee, connected to a wire loop through the toecap of the boot by a piece of parachute cord and a rubber tourniquet, the footdrops were corrected, and within a week the two nerve injury cases were walking around unaided. One of them at once hobbled away to his unit to go on with fighting.

The two other cases, together with a number of other badly wounded cases, we took by night to the Swiss frontier, when the journey across country was fairly free of German troops. The Swiss Red Cross authorities very kindly took them off to a hospital in Geneva. Their safe arrival on neutral territory relieved me of a headache of many weeks duration.

Abdominal wounds, in this type of warfare, carry with them an almost 100 percent death-rate, owing to the impossibility of operating under anything like proper surgical conditions. I was fortunate in having only one case of this sort due to enemy action; a man with two Spandau bullets through the left iliac fossa and the gluteal region and rectum. This man we managed to sneak down into the nearest town at night, where I operated on him in the local hospital which the Maquis "took over" under the noses of the Germans for the hour and a half required to get him to the hospital and into the theater, to repair some small bowel perforations, do a colostomy and open up the rectal wound. The man made a good recovery and was looked after by the nuns at considerable risk to themselves until, about two weeks later, we again came down into the town and took him safely away to Switzerland.

I saw one other abdominal wound due to an accident with a Sten gun, and I had the distressing experience of watching him die from intra-abdominal hemorrhage. At this time we were hidden in a granary many miles up the mountains and there was no possibility of getting him to proper surgical surroundings in time.

To turn briefly now to other sides of the work. For the period that I was in the Maquis we were very fortunate with the weather. Glorious sunshine for most of the time, though of course we had to keep to the darker parts of the forest during the day to avoid being spotted by the reconnaissance planes which were constantly about. It often rained at night and lying on beds made of branches, we got very cold and wet in the small hours of the morning; but usually we were up and moving by first light and so soon warmed up again. We had no cases of pneumonia, nor were there any complaints of the many minor afflictions of soldiers, during the periods of great activity. As soon as things got slack, everyone complained of everything, from colds to sore feet; but there were very few periods of inactivity.

A few words about hygiene in guerilla warfare. In my experience, every principle and rule known to the army manual on the subject was violated. During a period of severe privation, we killed and ate a goat and a few rabbits. Their carcases were hung from the branches of trees, and during the night men got up to pass feces within five yards of where the carcasses were hanging. As soon as the day warmed up, therefore, myriads of flies buzzed frantically backward and forwards between these two heaven-sent and unexpected meals. This was not an isolated instance; similar conditions were repeated many times. There were a few cases of diarrhea, but one of clinical dysentery. I attribute this to the fact that we never stayed in one spot for very long a time; at the most, two or three days. Being "on the run" has little to commend it as a way of living, but it has its compensations for the harassed M.O. (medical officer).

Everybody was lousy and flea-ridden, and we could do nothing about it. We had a small quantity of soap with us, but for a period of nearly three weeks the Germans cut us off from our water supplies by putting heavy machine-gun posts to guard the wells, and during this most distressing period each man had less than half a litre of water or diluted wine per day. Every drop of this was needed for drinking, as climbing about in the mountains in the hot July weather, with a large rucksack on the back and weapons to carry, caused much sweating, dehydration, and misery. We were reduced to trying to augment the daily half-litre by wiping the dew from the surface of the bracken with a rag and then sucking the rag. It took all the courage and example of Colonel Roman to keep up the men's morale at this time, and I think that I will remember it all my life.

Reflections

It is to be hoped that any reflections on war experiences of all kinds will only be in the nature of academic exercises, having no future applied value other than as historical records; but, the world being what it is the old methods of settling arguments without solving problems, it may perhaps not be entirely profitless to consider the best ways in which a surgeon might prepare himself for at least a few of the unpredictable eventualities of guerilla war.

Personal preparation should clearly consist of being extremely fit. "Toughness" is not a virtue, but here it is a necessity. Under famine conditions a fat man gets ill before a thin one, from acidosis due to rapid breakdown of his own fats, unsupported by the normal protein and carbohydrate intake. A thin man, on the other hand, too easily tires. Mentally, the M.O. must prepare himself for a life where nothing ever happens "according to plan" and where the extreme limits of improvisation will be required of him. He must also be prepared not only to "bear arms" but he should be skilled in their use, so that he may give a good account of himself should the necessity arise. Incidentally, he will get no respect or support from the fighting man unless he shows himself ready to play his part in this respect if called upon to do so.

So far as personal equipment is concerned, this must be of the smallest and most compact. Apart from the clothes he stands up in, the M.O. should take an extra woolen shirt, two handkerchiefs, and a pair of leather gloves; this should be enough for three months. Socks are unnecessary; they soon tuck up with heavy climbing and, in any case, wear out too quickly. If the feet are in good condition and the boots a perfect fit and well greased, all will be well. I did not wear socks at all while in France, and often did not take off my heavy boots for many days and nights, as the danger of sudden attacks and the need to "get off the mark" quickly was always with us, and I had no foot trouble the whole time.

Anti-louse powder is more important than soap if there is a water shortage, though both should, of course, be carried. Soap, however, is bulky and heavy. A very light, quilted sleeping bag -- alpine pattern -- is a great comfort, but it should be so cut that it can be quickly shed if necessary.

Medical supplies should be of a kind which are unlikely to be found on the spot. Sterilizing apparatus is out of the question; neither the sterilizer nor the fuel for it will last very long, and any farmhouse can produce enough boiling water for the type of surgery which will be done with a guerilla force. Swabs can be used and washed and boiled up over and over again if they have been well sewn up round the edges. Catgut is too bulky in practical quantities, and silk or linen thread spools can be resterilized repeatedly. Penthothal is probably the most portable and practical anaesthetic, particularly as the type of emergency operation to be done rarely takes longer than twenty minutes. Morphia in tablets is less bulky than ampoules, and 5cc and 10cc all-metal syringes are essential.

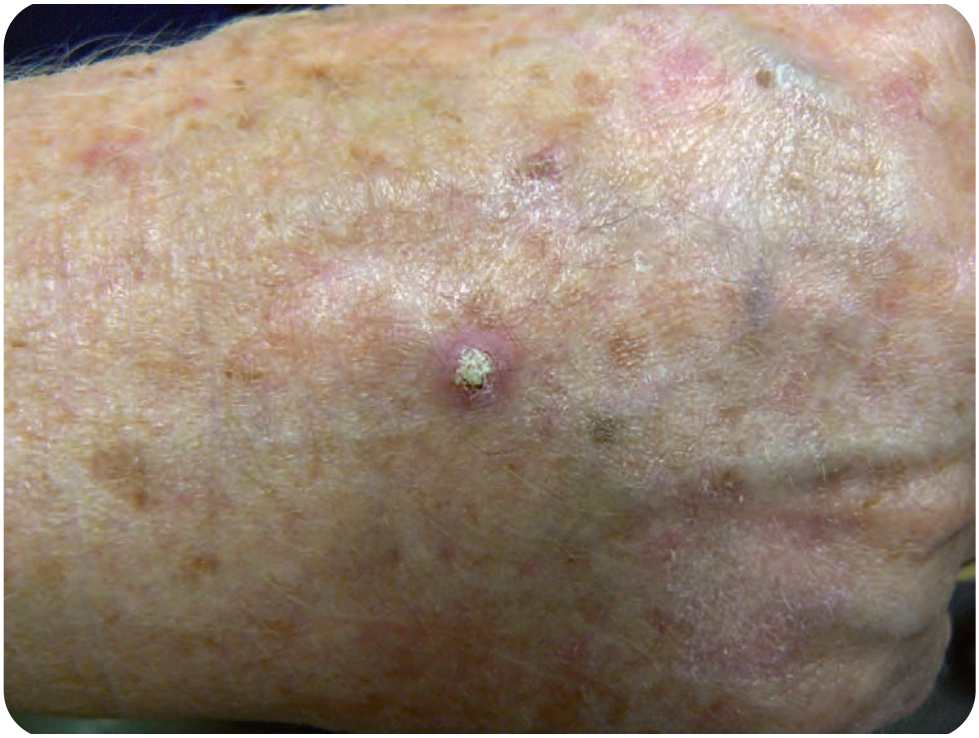
Prescience of the local conditions, as well as individual preferences, will naturally suggest modifications both in the personal and "bulk" packing.

I think that any man-and there are a number-who had experience of this sort of warfare, will agree with me that, apart from the extraordinary medical experience, a surgeon will come out of it the better for having lived awhile with men and women who live and fight for their ideals, unmoved by political cliches and propaganda.

PICTURE THIS….

Paige Neifert, MD; Darryl Hodson, MD

A fifty-six-year-old Soldier presents with a complaint of a persistent, scaling lesion on the dorsal side of his right hand for 12 months (see image below). It is painless, slowly enlarging, non-pruritic, and intermittently bleeds. He is fair-skinned and has a history of numerous sunburns. He denies any history of trauma. He is otherwise in good health, although he has a 30-pack-year history of smoking.



Question 1:

Using the primary lesion definitions outlined in your SOF medical handbook, how would you describe the morphology of this lesion?

Question 2:

What is your differential diagnosis for this scaling, pink papule?

Answer 1:

Morphology: This is a discrete, firm, 6 x 6mm, pink, scaling, papule with a thick hyperkeratotic center.

Answer 2:

The differential diagnosis includes: squamous cell carcinoma, hyperkeratotic actinic keratosis, Bowen's disease (squamous cell carcinoma *in situ*), prurigo nodule, foreign body granuloma, and keratoacanthoma. An actinic keratosis is usually a relatively flat papule, such that it is easier to determine that it is a raised lesion and thus a papule, by feel rather than by sight. These range in color from flesh-colored to pink to brown, with stellate, sandpapery, or adherent scale. These can develop a thick cutaneous horn and may be indistinguishable from squamous cell carcinoma, although typically squamous cell carcinoma has a more prominent base to the lesion than an actinic keratosis. Bowen's disease appears as a well-demarcated, pink to deep red, scaly, flat plaque on sun-exposed areas. A prurigo nodule is often pruritic and there is generally a history of manipulation or picking by the patient. Foreign body granulomas may be painful, and should have a preceding history of trauma (e.g., splinter, broken glass). A keratoacanthoma usually grows rapidly, then involutes and resolves over two to three months. Many experts consider keratoacanthoma to be a subset of squamous cell carcinoma and recommend treating this entity as such.

SQUAMOUS CELL CARCINOMA

Squamous cell carcinoma (SCC) is the second most common type of skin cancer, following basal cell carcinoma. There are approximately 200,000 new cases of cutaneous SCC diagnosed every year, resulting in over 2,000 deaths annually. The average age of diagnosis is 75-years-old, and this skin cancer is two to five times more common in men. Squamous cell carcinoma is associated with a defect in the p53 gene, which plays a role in tumor suppression. This is the most common defect in all human cancers.

Basal (BCC) and squamous cell carcinoma constitute 95% of all non-melanoma skin cancers, with a ratio of BCC: SCC of 4:1 in light-skinned individuals and 1:1.1 in dark-skinned persons. In pigmented skin, squamous cell carcinoma is the most common skin cancer and is more likely to be located on non-sun-exposed areas. Additionally, the risk of metastasis and death from cutaneous SCC is significantly increased in pigmented skin. Squamous cell carcinoma can develop on any skin surface or squamous epithelia (e.g., mucosal membranes, esophagus). The most important risk factor for developing cutaneous SCC is cumulative UV exposure over time. Other risk factors include: exposure to chemical agents (e.g., coal tar, petroleum oils, arsenic, soot), ionizing radiation, certain strains of HPV (anogenital, periungual), chronic ulcers, burn scars, certain genodermatoses (e.g., xeroderma pigmentosa, oculocutaneous albinism, epidermodysplasia verruciformis), tobacco use, PUVA phototherapy, history of organ transplantation, chronic immunosuppression, and AIDS.

Squamous cell carcinoma morphology may be variable, but it usually presents as a persistent, flesh-colored to pink to red, firm papule, with either a central hyperkeratotic mound or ulceration. There is a high predilection for sun-exposed areas such as the face, ears, exposed scalp, or dorsal side of thands/forearms. SCC is three times more common on the hand than BCC. Actinic keratoses are the precursor lesions to SCC, with a six to ten percent lifetime risk of conversion. It is therefore recommended that actinic keratoses be obliterated (either with cryotherapy, chemical peels, or topical chemotherapeutic agents), to decrease the risk of developing Bowen's disease or invasive squamous cell carcinoma.

The metastatic rate for cutaneous squamous cell carcinoma is 0.5 to 5%, which is lower than that for SCC involving other organs. However, squamous cell carcinoma metastases are much more likely in mucocutaneous lesions (11 to 30%), burns/scars (18 to 38%), and previously irradiated skin (20%). Further risk factors for metastasis include poorly differentiated tumor on histopathology, perineural invasion, location on the lip or ear, tumor size greater than 2cm, or depth greater than 4mm. Squamous cell carcinoma usually metastasizes to regional lymph nodes initially, although there have been rare cases of direct hematogenous spread.

The first step in diagnosing this form of skin cancer is to acquire tissue for pathological review. A shave biopsy of the entire lesion with either a scalpel or flexible razor blade should be performed, unless the lesion is very large, in which case a punch biopsy or a partial shave biopsy would be appropriate. Once a diagnosis of squamous cell carcinoma has been established, the gold standard treatment is excisional removal with 4mm margins or Mohs surgery if tissue conservation is required such as on the head. Excision with 4 to 5mm margins has a 95% cure rate if the lesion is well-circumscribed and less than 2cm diameter. Alternative treatments for superficial lesions would be electrodessication and curretage, cryosurgery, CO_2 laser, or possibly radiation therapy if the patient were a poor

surgical candidate although these treatments have lower cure rates.

Once the diagnosis of squamous cell carcinoma has been established, it is imperative to perform a thorough history and physical examination, including a full skin and regional lymph node evaluation, to ensure the patient has no other skin cancers and no evidence of metastases. Additionally, the patient should be counseled that he will need to have his skin examined every six to twelve months for his lifetime, to promote early detection of future lesions. Finally, he should be educated about the importance of sun protective clothing, avoidance of direct sun exposure during the "peak" hours (10 a.m. to 3 p.m.), adequate UVA/UVB sunblock protection, and self skin examination.

If you are DEPLOYED and have concerns about a puzzling skin condition, you can email your clinical photos and a concise morphologic description of the lesion to our Operational Teledermatology site at derm.consult@us.army.mil. The lesion you describe just may make its way to the next edition of **Picture This… Thanks for all you do.**

Lt Col (sel) Paige Neifert is a 1995 graduate of the University of Colorado School of Medicine. She completed her internship and residency in Family Practice at David Grant Medical Center, Travis AFB, CA from 1995—1998. She then served as a staff family physician at F.E. Warren AFB in WY from 1998—2000. She became a flight surgeon in 2000, and worked in this capacity at Patrick AFB 2000—2002, and then at Aviano AB, Italy from 2002—2005. LTC (sel) Neifert is currently in her second year of residency training in Dermatology at Wilford Hall Medical Center.

Darryl S. Hodson, MAJ, USA, MC is the assistant program director at Brooke Army and Wilford Hall Air Force Medical Centers. He received his medical degree from Wake Forest University, Winston-Salem, NC, and completed a Dermatology residence at University of Michigan, Ann Arbor, MI.

LTC Daniel Schissel originated "Picture This" for the MED Quiz. He is a 1993 graduate of the Uniformed Service University of the Health Sciences and completed his internship with the family practice department at Fort Bragg in 1994. He then served as the 2/10th Special Forces Group (Airborne) Surgeon and followed on as the 10th SFG(A) Group Surgeon. He completed his residency training in dermatology at the Brooke Army Medical Center in 1999. LTC Schissel is presently stationed in Heidelberg, Germany as a staff physician and the European Regional Medical Command Dermatology Consultant. He has been selected as the U.S. Army OTSG Dermatology Consultant. LTC Schissel has authored the dermatology section of the new SOF manual, serves on the USSOCOM Medical Curriculum and Examinations Board, and is the U.S. Army Aviation Dermatology Consultant.

References

1. Ponten, F., & Lundeberg, J. (2003). Principles of Tumor Biology and Pathogenesis of BCCs and SCCs. In J. L. Bolognia, J. L. Jorizzo, & R. P. Rapini (Eds.), *Dermatology* (pp. 1663—1676). Edinburgh: Mosby.
2. Miller, S. J., & Moresi, J. M. (2003). Actinic Keratosis, Basal Cell Carcinoma and Squamous Cell Carcinoma. In J. L. Bolognia, J. L. Jorizzo, & R. P. Rapini (Eds.), *Dermatology* (pp. 1677—1696). Edinburgh: Mosby.
3. James, W. D., Berger, T. G., & Elston, D. M. (2006). *Andrews' Diseases of the Skin: Clinical Dermatology* (10th ed.), (pp. 652—656). Philadelphia: Elsevier.
4. Gloster, H. M., & Neal, K (2006). Skin cancer in skin of color. *Journal of the American Academy of Dermatology,* 55(5), 741-60.
5. Wood, G. S., Bagheri, M., Gharia, M., Gordon, E., Larson, P. O., & Snow, S. N. (2004). Nonmelanoma Skin Cancers: Basal Cell and Squamous Cell Carcinomas. In M. D. Abeloff, J. O. Armitage, J. E. Niederhuber, M. B. Kastan, & W. G. McKenna (Eds.), *Clinical Oncology* (3rd ed.), (pp. 1589—1609). Philadelphia: Churchill Livingstone.
6. Motley, R., Kersey, P., & Lawrence, C. (2002). Multiprofessional guidelines for the management of the patient with primary cutaneous squamous cell carcinoma. *British Journal of Dermatology*, 146: 18-25.

Human Performance Forum

Human Performance Forum Introduction

To date we have taken an in-depth look at functional screening, implementation of professional sports models in SOF, and emerging human performance (HP) vocabulary. Our forum this quarter continues to expand the dialogue and knowledge base of our readers for the mission essential aspects of the professional sports model and how it functions in the civilian sector.

This article provides a narrative interview with Mr. Jon Torine, a professional strength and conditioning (S & C) coach currently employed in the National Football League. Our subject has over 15 years of experience teaching, leading, and restoring athletes over a 10-month window. This time continuum is remarkably similar to our tactical athletes' inter-deployment training cycle. As such, we can illustrate by comparison the capability gaps in our efforts to adequately provide athlete services for the SOF weapons system. First and foremost is the absolute void of career professionals dedicated to S & C in SOF. As of this edition only two exist to support a fragment of over 40,000 SOF personnel.

During this interview almost every question returned to the concept of preserving human capital. This philosophy is a daily challenge for those in the S & C profession at the highest levels. As we are all aware, human assets not available for their intended purpose can be considered mission failure. We habitually, and at times deliberately, degrade and injure our resources before we get to game day due to cultural resistance to change and ignorance of performance methodologies that have emerged. Within the Surgeon's Office we are challenging conventional thought and conventional wisdom at each juncture. Ultimately we require closed loop human resources that are industry experts in their respective fields. In previous forum editions we have directly challenged the concept of health as defined by the DOD. It is necessary, if not critical, to define our own standards when it comes to what is necessary to preserve human capital.

Mr. Torine provides a unique look into the realm of S & C involved in a sport that is fundamentally based on attrition and exhibits unique physical violence. We greatly appreciate his time and effort to help develop this article. We also appreciate our readers who submitted these questions and the military clarifiers that came with them. We would also like to share with our audience a recent success we had with attaining a change in doctrine at the Joint Chiefs level regarding the perishable nature of human resources. The Joint Chiefs Doctrine Branch released Joint Publication 3-05.1 in April 2007. It contains the following passages that recognize the critical need to preserve out assets. Paragraph d. is a succinct articulation of the requirement and the gap that we are describing in the Doctrine, Organization, Training, Material, Leader Development, Personnel, and Facilities (DOTMLPF) process.

CHAPTER I
DOCTRINAL OVERVIEW OF JOINT SPECIAL OPERATIONS

"We need a greater ability to deal with guerrilla forces, insurrection, and subversion . . . We must be ready now to deal with any size force, including small externally supported bands of men; and we must help train local forces to be equally effective."

President John F. Kennedy, Message to Congress, 1961

1. Special Operations Forces

Special operations forces (SOF) are small, specially organized units manned by people carefully selected and trained to operate under physically demanding and psychologically stressful conditions to accomplish missions using modified equipment and unconventional applications of tactics against strategic and operational objectives.

d. SOF limitations stem from their few numbers and the time needed to develop and replace highly trained people and units. Additionally, focused efforts are essential to preserve the force in the face of occupational injury and illness and to rapidly recover and recondition people to the demanding standards required for return to duty and mission capable status. Austere SOF logistic support systems require extensive support from conventional force structures supplemented by host nation (HN) and/or contracted support. SOF are organized and trained for employment against targets of strategic and operational relevance. SOF are not used as a substitute for conventional forces. SOF truths stem from the capabilities and limitations associated with SOF and are depicted in Figure I-1.

5. Special Operations Forces Shape Environment and Set Conditions

In likely or potential operational areas, SOF play a major role in preparing and shaping environments, and they may set conditions that mitigate risk and facilitate successful follow-on

Figure I-1. Special Operations Forces Truths

GMM: What emerging technologies, or exercise physiology, do you feel hold the most impact for training improvements in the near term or distant horizon?

JT: The technologies always follow the tracking of the advances in physiology. Once we decide what emerging physiologies we want to track, the technology follows. Database management in that aspect is critical when tracking larger groups, teams, or personnel. That being stated, there is an exciting paradigm shift emerging in training and conditioning. That shift is taking place in the following areas. First, an objective measure of characterizing how individuals perform in fundamental movement patterns. These are movements every human being undergoes as part of motor development. At some point we have these and through injury, compensation, and/or poor training we tend to lose them. I am specifically referring to those movements that are part of the Functional Movement Screen as developed by Gray Cook and Lee Burton of Danville, VA. These are squatting, stepping, lunging, active straight leg raise, trunk pushup, shoulder mobility, and rotary stability. By putting people through these aforementioned patterns we can objectively look at their stability and mobility in human movement patterns. Once defined, there is a system by which these patterns can be corrected before moving onto any advanced training. Once corrected, the advanced training is then taken to greater heights as we have opened up mobility in the individual under a stable base. From there, anything is possible to the person's limits.

The second paradigm shift is that of power training. Power training used to consist of lifting a heavy load as in the power clean and moving it until the lift was completed. When we break down and recognize the definition of power we understand that load, speed, and distance are the components. By improving speed we improve power or speed strength. Obviously the equation plays off of itself by manipulating the numerator and/or the denominator. We time our lifts in meters per second and speak in terms of speed. What we have learned is to truly train power we must release so as not to have an eccentric braking action towards the "top" of the lift. By doing bench throws and jump squats on equipment made by Cormax we have been able to release our bench throws and bring the load down at a controlled rate of speed and do jump squats with a load and land only with the load of our own bodyweight, while the weighted load is lowered at a set rate of speed. We have been able to design meters per second prescriptions based on set and rep schemes that have shown greater increases in power than we have ever seen. Power is truly what defines how fast a person can move something, whether an external load alone or with their bodyweight and an external load. Strength speed is the foundation of power and power is the foundation of sport. We have seen our power numbers also improve our base strength where it has not been before.

GMM: What are the primary drivers of your methodology today? Please elaborate on the person, time, place, or event that set your baseline or changed your approaches recently.

JT: The primary drivers of the methodology we use today come from the following areas. I started my career as an assistant strength and conditioning coach with the Buffalo Bills and worked under Head Strength and Conditioning Coach, Rusty Jones. After spending 20 years in Buffalo, NY, Rusty moved to Chicago to become the head strength and conditioning coach with the Bears. Rusty is regarded as one of the finest strength coaches in the country. He has been my mentor and one of my best friends since 1995. As an aside, standing on the opposite sideline of him during Superbowl XLI was a tough ordeal, but it was nice to come out of the game with a win. It was in Buffalo where I learned how to be a strength coach from a physiologic and philosophical standpoint. We set a base there to run our nutrition program where the components of ideal body composition, recovery

physiology, electrolyte and hydration assignments, exact grams of micronutrients, and understanding that carbohydrate will always run the engine serve as the primary philosophy as we teach athletes how, what, and when to eat. The base of our anaerobic conditioning program is where we define our interval training done by an individual off of supramax functional capacity, as well as our individual position specific conditioning done at the work / rest intervals of our no huddle pace as well as a two minute win the game type pace. Strength training based on basic principles of overload and proactive injury prevention were formed.

In 2002, we met Gray Cook and Lee Burton. We had already been studying the Functional Movement Screen (FMS) that they developed, but brought Gray in to show us the program. From that moment on, a paradigm shift took place in how we view, train, and speak about our players. The FMS serves a multifaceted role in our organization. Our doctors now require it prior the physicals being done on our players. We put a player through the screen and then communicate either verbally or in writing what we have seen with the screen as far as movement patterns, stability, and mobility issues. Our orthopedists then feel they can be more specific in what they are looking at in the physical.

It is a determinant of return to play after an injury. So, if a player does not have a satisfactory score or is highly asymmetrical, they will be held from returning to play from injury until the movement screen score is sufficient. It is the foundation of our training program. Each player, prior to training with us, goes through the screen. Once we have scored it, we can enter it into a piece of software that generates what corrective exercise, whether simple myofascial stick work, stretching, assistive work, stabilization exercises, or reactive neuromuscular training, that athlete needs to do as part of his movement preparation before he begins to train with bigger strength and power exercises. This has improved every area of training we know and has shown promise in the reduction and possible prediction of our long term injuries.

Dr. William Kraemer of the University of Connecticut, widely regarded as one of the top physiologists of our time, has been instrumental. We are currently implementing a type of periodization that he has written and studied now as undulating or non-linear periodization. Very simply, this system is a matter of manipulating training by session, where each session has a specific and unique purpose. One day may be a heavy strength day, another could be a heavy power day, another, a light strength day, and another a high rep day or an active recovery day. The days can be changed, whether planned or unplanned. Having the session unplanned allows the athlete to come in and subjectively and/or objectively measure his physiologic and mental state of readiness. A simple question of a how do you feel rating can be used; or measures such as vertical jump, hang clean, or another power or strength exercise. If the test is performed at a high level, they are ready for heavy power training. Training for the day will depend on mental and physical state and performance.

GMM: SOF is seeking enablers and catalysts to improve resilience in their operators. Given the critical need to keep your players effective over a potential seven month window, how do you initially develop and subsequently retain resilience?

JT: From a physiologic standpoint, the ability to keep players effective over the long term is quite a challenge. However, there are strategies that have proven effective. First, mental "freshness" is critical and that starts with the leadership at the top of our organization. Our head coach and president have an outstanding awareness and place primary emphasis on keeping the players mentally inspired through coaching techniques, schedules for practice and conditioning, travel schedules, and appropriate lengths of meeting time. Next, our job is to maximize physiologic effectiveness through proper training and recovery, and schedule around that. Proper meal timing and nutrients are key components. We strive to load our players with low to moderate glycemic index carbohydrates throughout the day and high glycemic carbs post-training. We have a system in place that automatically dictates to a player the fluid ounces, millimoles of electrolytes, and glycogen re-synthesis numbers he must consume post practice, game, or training; all based on bodyweight and weight loss with activity. Each player has his own individualized numbers and they drink and eat right to those numbers. The first 15 to 45 minutes are critical for anabolic recovery and then a quality meal within 120 minutes to be able to still take advantage of the increased nutrient utilization. We look at a player's specific gravity of urine and take advantage of these numbers as well. The deleterious effects of heat, travel, multiple practices, and training in succession, can lower performance levels. Obviously, it is our job to minimize these effects. We look at our schedule and base time of travel, curfew, and practices on circadian rhythm, whether we play at night, at 12:00 central, or on the West Coast. Anaerobic conditioning during the season is mostly handled through practice, but is adjusted based on playing time and position. Our training is a two day plan that is designed to increase strength and power while

not tearing down the player. The combination of the above is the way we try to enhance this quality.

GMM: What supporting pillars within the professional sports model do you consider the most critical to achieve your strength and conditioning objectives?

JT: Supporting pillars are integral to the strength and conditioning objectives. First, a physical therapist and an athletic trainer are the primary partners for a strength coach. These two professionals work hand-in-hand. Whether it is the therapist doing joint mobilization techniques and taping to enhance the movement patterns that the athlete will work on with the strength coach or guiding each other through the progressions of rehab, there is not a more important partnership for the athlete to hold his trust. Along those lines, the team physician is critical as he drives the rehab protocol and the overall medical wellness of the athlete. Researchers are important as we continue to bridge the gap between the clinical and the applied. Once researchers discover what to do and maybe more importantly, what not to do, those of us on the application side will and should take their directive.

GMM: What exercise physiology research topic would you like to see conclusively studied in 2007?

JT: The research area or topic I would like to see most conclusively studied is injury prediction. What characteristics do people share that make them more prone to injury? Is there a single or multiple objective measure to use?

GMM: What methods or systems do you subscribe to screen athletes in a pre-participation environment? Do you consider them critical, essential, or enhancing?

JT: In a pre-participation environment we screen and test the following physical parameters. The tests to which I refer are limited to those done by the S & C staff. The Functional Movement Screen is a mandatory test for our players, done as part of the pre-participation physical. Next is determining an initial body composition, i.e., percentage body fat, fat-free mass, fat mass, and total weight. We use the Bod Pod® as our measuring tool. We then take each players resting metabolic rate (RMR) either by direct measurement or a prediction equation based on lean weight taken from Niemann out of Appalachian State. This body composition measurement begins the process for our nutrition program where we assign players percent body fat as primary importance followed by their appropriate body weight. However, the composition of lean weight to fat weight is what drives the entire process. The RMR allows the strength coach the ability to design diets based on grams of micronutrients and total calories. This is a critical test for us and we will test players at regular intervals throughout the entire season. Next, we will establish a base max VO_2 on our players. This determines the percent of max, either sub or supramax, for the individual who runs our interval training program. We will graduate down from two minutes of running with two minutes of rest to two seconds of running depending on the objective and macrocycle that we are training in. Finally we establish an upper and lower body power test where we take 50% and 75% of the individual's bodyweight and have them perform an upper body explosive bench test (Cormax) and lower body explosive squat (Cormax) performing the given reps and establish statistical data from there. The training for this power is done differently, but we will go back and test this same way again to see where things have changed. This test is set up this way in order to evaluate the team against itself as well as look at fat free mass and total bodyweight relative to power. This test is enhancing and is leaning toward becoming essential. Strength is established by looking at the previous years' accomplishments as a pre-participation screen; however, no formal strength test is done as our daily recordings of weights serve that role.

Jon Torine is in his 10th season as strength and conditioning coach of the Indianapolis Colts. Torine oversees all aspects of the club's strength, conditioning, and nutritional programs. He previously served as a conditioning assistant with the Buffalo Bills from 1995 to 97, where he was involved with the same aspects of the Bills' programs. In his position with the Colts, Torine has the primary responsibility of developing a year-round strength and conditioning routine for all players. Torine supervises players' diet/nutritional needs throughout the year, and he coordinates all meal plans for home and away games. He also assists the team's medical staff with the rehabilitation of injured players. Torine has served on panels for the United States Olympic Committee, the American College of Sports Medicine, Gatorade/Gatorade Sports Science Institute, and Sports Cardiovascular and Wellness Nutritionists (SCAN). Torine has served as a speaker for the National Strength and Conditioning Association. In 1999, Torine designed the club's 6,000 square foot weight room at the Union Federal Football Center. Torine played football at Springfield (MA) College. He received his bachelor's degree in exercise science.

Dedication

Technical Sergeant Scott E. Duffman
14 August 1974 – 17 February 2007

Of the 22 coalition personnel on board, TSgt Duffman and seven others were killed while 14 were injured when their helicopter crashed. They were supporting Operation Enduring Freedom.

According to a coalition press release, the helicopter pilot reported a sudden loss of power and control just prior to the crash.

TSgt Duffman, a pararescueman, was assigned to the 24th Special Tactics Squadron at Pope Air Force Base, N.C. The 24th STS falls under the 720th Special Tactics Group, a unit in Air Force Special Operations Command at Hurlburt Field, Florida.

Lt Col Robert Armfield, Commander of 24th Special Tactics Squadron, described Scott Duffman as an exceptional pararescueman, friend, husband, and father. "He loved his profession and loved his family," he said "Losing him is a tragedy but we are all consoled by the fact that he died strong, doing what he loved: going into harm's way so others may live."

TSgt Duffman was born on 14 August 1974 and spent the majority of his childhood in Albuquerque, New Mexico. Following his graduation from La Cueva High School, Scott joined the United States Air Force in October 1992 and then completed a challenging series of training schools that culminated with earning the maroon beret of the Air Force Pararescuemen. Scott served as a Pararescueman in a number of units to include the 56th Rescue Squadron in Keflavik, Iceland and the 23rd Special Tactics Squadron before being assigned to the 24th Special Tactics Squadron in April of 2001.

TSgt Duffman has been awarded the Bronze Star Medal w/ Valor and two devices, the Defense Meritorious Service Medal, the Air Medal with two devices, the Air Force Commendation Medal with three devices, and the Air Force Achievement Medal with two devices.

Scott leaves behind his wife and infant daughter.

Journal of Special Operations Medicine

Special Forces Aidman's Pledge

As a Special Forces Aidman of the United States Army, I pledge my honor and my conscience to the service of my country and the art of medicine. I recognize the responsibility which may be placed upon me for the health, and even lives, of others. I confess the limitation of my skill and knowledge in the caring for the sick and injured. I promise to follow the maxim "Primum non- nocere" ("First, thou shalt do no harm"), and to seek the assistance of more competent medical authority whenever it is available. These confidences which come to me in my attendance on the sick, I will treat as secret. I recognize my responsibility to impart to others who seek the service of medicine such knowledge of its art and practice as I possess, and I resolve to continue to improve my capability to this purpose. As an American Soldier, I have determined ultimately to place above all considerations of self the mission of my team and the cause of my nation.

Pararescue Creed

I was that which others did not want to be. I went where others feared to go, and did what others failed to do. I asked nothing from those who gave nothing, And reluctantly accepted the thought of eternal lonliess ... should I fail. I have seen the face of terror; felt the stinging cold of fear, and enjoyed the sweet taste of a moment's love. I have cried, pained and hoped...but most of all, I have lived times others would say best forgotten. Always I will be able to say, that I was proud of what I was: a PJ It is my duty as a Pararescueman to save a life and to aid the injured. I will perform my assigned duties quickly and efficiently, placing these duties before personal desires and comforts.

These things I do,
"That Others May Live."

A Navy Poem

I'm the one called "Doc"... I shall not walk in your footsteps, but I will walk by your side. I shall not walk in your image, I've earned my own title of pride. We've answered the call together, on sea and foreign land. When the cry for help was given, I've been there right at hand. Whether I am on the ocean or in the jungle wearing greens, Giving aid to my fellow man, be it Sailors or Marines. So the next time you see a Corpsman and you think of calling him "squid," think of the job he's doing as those before him did. And if you ever have to go out there and your life is on the block, Look at the one right next to you...

I'm the one called "Doc".

~ Harry D. Penny, Jr. USN

UNITED STATES SPECIAL OPERATIONS COMMAND
ATTN: SOCS-SG
7701 Tampa Point Blvd.
MacDill AFB, FL 33621-5323
OFFICIAL BUSINESS

MEDIA MAIL